Инструменты для физиологических измерений

Описание

По вопросам продаж и поддержки обращайтесь:

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Modular Evolution Chassis

The EVO Chassis provides the power to the FISO signal conditioner modules as well as the digital interface for data transfer between the signal conditioners and the Evolution Software.

Item No.	Description
75-0700	FISO Evolution Series EVO-2 Chassis, 24 VDC, 70 W, for Mounting up to 2 FISO Signal Conditioners
75-0701	FISO Evolution Series EVO-5 Chassis, 24 VDC, 70 W, for Mounting up to 5 FISO Signal Conditioners

DETAILS

The EVO Chassis provides the power to the FISO signal conditioner modules as well as the digital interface for data transfer between the signal conditioners and the Evolution Software. The EVO Chassis (2- and 5-channel version) includes the Power/Interface module, Evolution data acquisition and instrument control software, USB cable, power supply, and module removal tool. The Power Supply/Interface module has a USB2.0 output and includes the Evolution software. The 2–Channel chassis can house up to 2 FPI signal conditioning modules, while the 5–channel can house up to 5. Chassis do not need to be filled to capacity for use. Add more signal conditioners at any time up to the capacity of the chassis. The data sampling rate of up to 15 kHz offers the ability to accurately detect fast–changing pressure signals, such as that from mouse heart. Visualize the dichrotic notch with ease! Data is either transferred into the computer via USB to the Evolution acquisition software (at up to 5 kHz) or via the analog output (up to 15 kHz) to an independent data acquisition system.

Differential Low Pressure Transducers DLP2.5

For very low differential pressure measurements, usable for all types of pneumotachometers in respiration studies

Item No.	Description
73-3882	Differential Low Pressure Transducer DLP2.5, range +- 2.5 cmH2O, HSE Connector
73-3999	Differential Low Pressure Transducer DLP2.5, range +- 2.5 cmH2O, ADI ML110, ML112 or News Versions Connector
73-0500	Lab Stand with Triangular Base Plate, 30 cm Rod Length (one block clamp included)

DETAILS

These Differential Pressure Transducers are designed for very low differential pressure measurements. They are especially suitable for airflow measurement in respiration studies using pneumotachs. They are used in combination with plethysmographic boxes, isolated lung systems and all types of pneumotachs.

The Transducer element is temperature compensated over a large temperature range. It has small internal volume and a very low volumetric displacement to achieve good frequency response.

This Transducer can be connected to a standard strain gauge amplifier like a PLUGSYS Module type .

PLUGSYS Transit Time Flowmeter Module (TTFM-2)

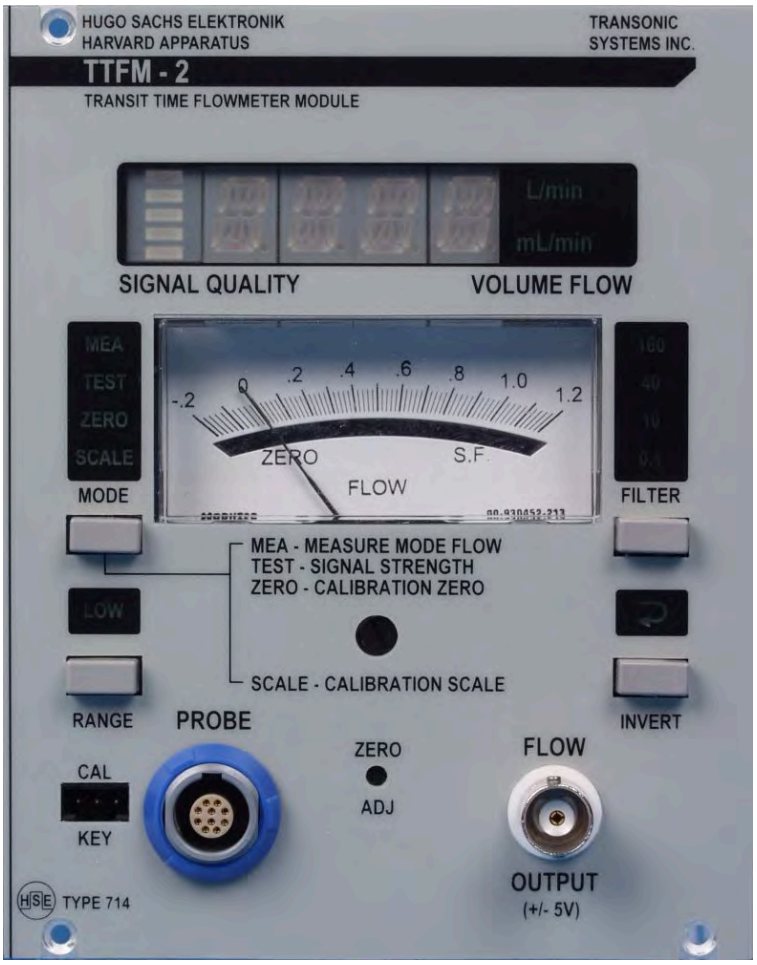
Limited available quantities. Please contact us for further information.

Used to measure blood flow in-vivo or flow rates of any perfusion solution in isolated organ systems.

Click this link for recommended .

Clock this link for recommended .

Item No.	Description
73-4617	Transit Time Flowmeter Module (TTFM-2)



DETAILS

The **Transit Time Flowmeter Module** (TTFM-2) is an ultrasonic transit time flowmeter module used to measure blood flow in-vivo or flow rates of any perfusion solution in isolated organ systems. It incorporates a complete 1-channel Transonic® ultrasonic transit time flowmeter which must be connected to a PLUGSYS housing. It can be used either with in-line flow probes or perivascular probes from Transonic.

The module features a built-in digital display for direct reading of the mean flow and an analog instrument to show flow, signal quality and scale factors. This module requires a PLUGSYS housing or with five PLUGSYS slots. The module includes a 1.25 M extension cable (73-4706).

The TTFM-2 module should be added to a PLUGSYS amplifier that also includes modules to measure pressure, ECG, temperature and other physiological parameters.

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Clock this link for recommended .

Click this link for more information about .

Extension Cables

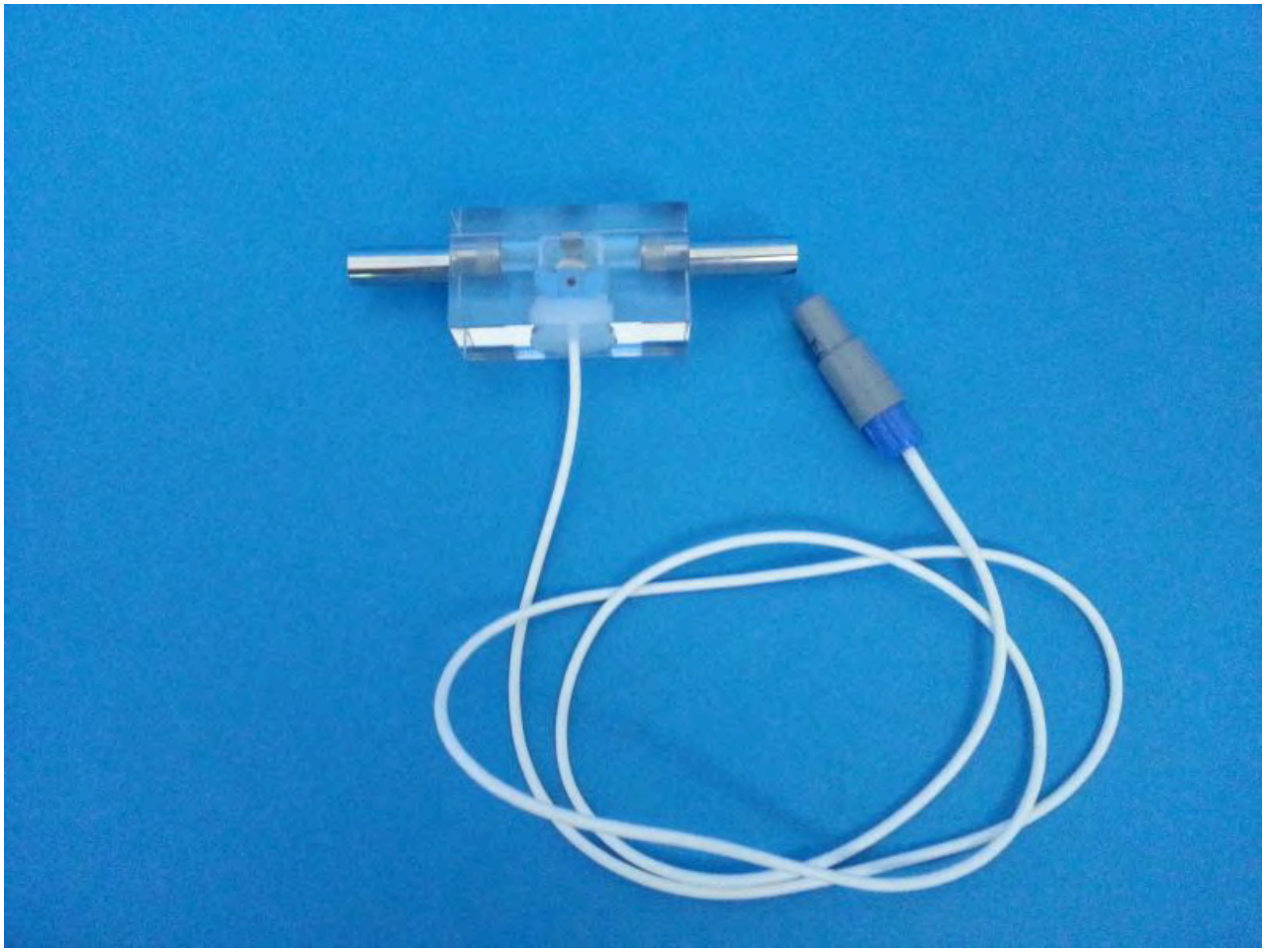
73-4706 Extension Cable for TTFM-2, CRA10-S-CRA10
73-4707 Extension Cable for TTFM-2, CRA10-M2-CRA10 (Cannot be used with 0.5 and 0.7 mm nanoprobes)
73-4708 Extensiion Cable for TTFM-2, CRA10-M3-CRA10 (Cannot be used with 0.5 and 0.7 mm nanoprobes

Extracorporeal In-Line Flow Probes for TTFM-2 Flowmeter Modules

Extracorporeal in-line flow probes monitor perfusion flow on isolated organs and are built into the perfusion lines (tubing). For use with .

These extracorporeal in-line probes are available in sizes from 1.0 to 8.0 mm. All in-line flow probes are cannulated and options are available for a larger range of species.

Item No.	Description
73-4753	Inline Flow Probe, type 1N for TTFM-2. cannulated, 1 mm ID
73-4754	Inline Flow Probe, type 2N for TTFM-2, cannulated, 2 mm ID
73-4755	Inline Flow Probe, type 4N for TTFM-2, cannulated, 4 mm ID
73-4946	Inline Flow Probe, type 6N for TTFM-2, cannulated, 6 mm ID
73-4947	Inline Flow Probe, type 8N for TTFM-2. cannulated, 8 mm ID
73-5131	Inline Flow Probe, type 12N for TTFM-2. Cannulated, 12 mm ID
73-5233	Inline Flow Probe, type 16N for TTFM-2. Cannulated, 16 mm ID



DETAILS

Extracorporeal in-line flow probes monitor perfusion flow on isolated organs. For use with in isolated organ systems such as abdominal organs or lungs, or for any application where a flow in a tube must be measured.

These probes are embedded into a perspex holder which has two ports. There are installed into an in-line tubing. These probes are available in sizes from 1.0 to 8.0 mm. All in-line flow probes are cannulated, and options are available for a range of species.

SPECIFICATIONS

		Resolution	Low Flow	Normal	Max Flow	Zero Offset	Absolute Accuracy	Relative accuracy

Part No	Model	ml/min	1V output in ml/min	1V output in ml/min	5V output in ml/min	ml/min	% of reading	%
73-4753	1N	0.05	5	20	100	±0.2	±10	±2
73-4754	2N	0.1	25	100	500	±1	±10	±2
73-4755	4N	0.8	100	400	2L	±4	±10	±2
73-4946	6N	2.0	250	1L	5L	±10	±10	±2
73-4947	8N	4.0	500	2L	10L	±20	±10	±2
73-5131	12N	8.0	1L	4L	20L	±40	±10	±2
73-5233	16N	20	2.5L	10L	50L	±100	±10	±2

Isometric Force Transducers, Models FT20 and FT50

The FT20 and FT50 force transducers are designed for measurement applications in tissue bath experiments where isometric muscle or tissue contraction are measured.The FT20 and FT50 force transducers are designed for measurement applications in tissue bath experiments where isometric muscle or tissue contraction are measured.. The FT20 has a maximal load of Â± 20 cN (~20 g force) and the FT50 has a maximal load of Â± 50 cN (~50 g force).

Item No.	Description
73-4986	FT20 Isometric Force Transducer ± 20 g, includes 6 Pin DIN cable for HSE amplifiers
73-4987	FT50 Isometric Force Transducer ± 50 g, includes 6 Pin DIN cable for HSE amplifiers
73-5035	FT20 Isometric Force Transducer ± 20 g, includes 8 Pin DIN cable for ADI amplifiers (Compatible with AD Instruments bridge amplifiers model ML110, ML112, ML221, ML224, ML228, FE221, FE228, FE224)
73-5036	FT50 Isometric Force Transducer ± 50 g, includes 8 Pin DIN cable for ADI amplifiers (Compatible with AD Instruments bridge amplifiers model ML110, ML112, ML221, ML224, ML228, FE221, FE228, FE224)
73-5037	Replacement 6 Pin DIN Connection Cable for FT20 or FT50 transducers to HSE amplifiers

DETAILS

The FT20 and FT50 force transducers are designed for measurement applications in tissue bath experiments where isometric muscle or tissue contraction are measured. The FT20 has a maximal load of ± 20 cN (~20 g force) and the FT50 has a maximal load of ± 50 cN (~50 g force).

The installed sensor system is based on a resistance full bridge circuit, which can be directly connected to any HA-HSE bridge amplifier, e.g. the PLUGSYS TAM amplifier module. If using other DC bridge amplifiers, e.g. Grass or Gould, there are different connection cables available.

Key Features

- Isometric (low displacement of the measurement cell)
- Can be used in both directions, pull or push
- Two ranges available +/-20 g, and +/-50 g full scale (FS)
- Suitable for small muscle and tissue samples like papillary muscle, Purkinje fibers and vessel rings
- Resistance full bridge circuit (Wheatstone bridge) can be used with most commonly used DC bridge amplifiers
- Supply voltage range 5 to 10 VDC (max. 15 mA

- Removable connection cable with 6-pin binder connector for HA-HSE bridge amps or additionally available special cables for products from other manufacturers, e.g. Grass or Gould.
- Removable holder with two M5 fastening threads for horizontal or vertical rod mounting
- Compact design, two mechanical end stops as overload protection and additional front

Included Items

- Force transducer FT20 or FT50
- Removable holder with 8 mm mounting rod
- Standard connection cable
- Small spring attachment hook
- Test weight 1 cN (~1 g)
- Hexagon screwdriver 2.5 mm
- User's manual
- Storage box

See the Specifications tab for additional details.

SPECIFICATIONS

Parameter	**FT20**	**FT50**
Maximal load	± 20 cN (~20 g force)	± 50 cN (~50 g force)
Natural frequency	210 Hz	300 Hz
Bridge resistance	Signal = 1.6 kOhm / Supply = 820 ohm	Signal = 1.6 kOhm / Supply = 820 ohm
Supply voltage	+5 to 10 VDC <20 mA	+5 to 10 VDC <20 mA
Displacement	8 µm / 1 cN	4 µm / 1 cN
Sensitivity	250 µV / 1V / 1 cN	58 µV / 1V / 1 cN
Shielding	Housing, holder and rod connected to shield	Housing, holder and rod connected to shield
Sensor moving mass	<1.1 cN (~1.12 g)	<1.1 cN (~1.12 g)
Operating temperature	10°C to 50°C (50°F to 122°F)	10°C to 50°C (50°F to 122°F)
Weight	120 g (Sensor and holder without cable)	120 g (Sensor and holder without cable)

Transducer dimensions (W x H x L)	21 x 21 x 64 mm 0.83 x 0.83 x 2.52 in	21 x 21 x 64 mm 0.83 x 0.83 x 2.52 in
Connecting socket	USB 2.0 A type socket / supply and signal (No USB interface)	USB 2.0 A type socket / supply and signal (No USB interface)
Connection cable	Standard cable 6-pin Binder 2 m / 78 in Optional for ADI, Grass and Gould	Standard cable 6-pin Binder 2 m / 78 in Optional for ADI, Grass and Gould
Rod length	8 x 160 mm (0.315 x 6.3 in)	8 x 160 mm (0.315 x 6.3 in)
Mounting holder for rod	Removable horizontal or vertical mount	Removable horizontal or vertical mount
Accessories	Standard connection cable, test weight and instruction	Standard connection cable, test weight and instruction

Stimulator C Square Wave Pulse Stimulator

The Stimulator C is a compact, highly stable square wave pulse stimulator that features precise digital timing control. A large LCD display (2 lines at 40 characters) and minimum of controls make setup and operation easy.

Ideal for pacing with isolated heart systems.

Item No.	Description
73-3713	Stimulator C, 230 VAC, 50 Hz
73-3716	Stimulator C, 115 VAC, 60 Hz

DETAILS

The Stimulator C is a compact, highly stable square wave pulse stimulator that features precise digital timing control. A large LCD display (2 lines at 40 characters) and minimum of controls make setup and operation easy.

All relevant stimulation parameters are shown on the display which provides a rapid view of the current settings. Several stimulation modes are possible (repetitive, single, triggered, tetanic...). The last settings used are always stored in memory and recalled when the unit is turned on. Two stimulation patterns can be pre-defined and stored in the non-volatile memory. These patterns can easily be recalled by selecting them in the menu.

The basic rhythm can be displayed either as frequency in Hertz or as period in msec respectively. The adjustment of the timing is controlled by a microcontroller to avoid wrong settings.

The powerful (20 VA) and fast (rise and fall time < 1 µs) constant voltage (up to 50 Volt) output allows stimulation of all types of tissues from direct contact nerve to tissue bath field stimulation. The output is floating, not connected to earth (ungrounded). The output has a very low impedance (< 0.1â„¦). The maximum output current is ±400 mA.

SPECIFICATIONS

Stimulation Mode	SINGLE: single stimulus triggered by MANUAL button or by remote contact
	FREE RUN: repeating stimulus
	GATED: repeating stimulus triggered by MANUAL button or by remote contact
	TRIGGER: pulse (TTL, negative-going edge) starts delay circuit
	TETANIC: 50 Hz duty cycle square wave. Burst of 2.5 sec maximum duration gated by MANUAL button or remote contact
Stimulation Timing Frequency	0.01 to 1000 Hz in 42 coarse steps and and continous fine setting with 10 µs resolution respectively
	1 ms to 100 s in 41 coarse steps and and continous fine setting with 10 µs resolution
Delay Time	(Leading the stimuli): 0.1 to 500 msec in 32 coarse steps and and continuous fine setting with 10 µs resolution
Width	10 µsec to 100 msec in 32 coarse steps and continuous fine setting with 2 µs resolution

Stimulus Output	1. Output voltage 0 to 50 V; Current ±400 mA (rise and fall time < 1 µs at 50 V ±400 mA) 2. Monophasic (Pos or Neg), Biphasic, Alternated 3. Output circuit floating, not connected to earth (ungrounded)
Indication	1. LCD display (2 lines of 40 characters each with LED backlight) to indicate stimulus parameters and settings 2. LED for stimulus pulse 3. Beep (to indicate errors in setting)
Trigger Input/Output	BNC socket Input or Ouput depending on the selected mode.
Input Signal	TTL level, negative edge or active low
Output Signal	TTL level active low
Weight	2.5 kg (5.5 lb)
Dimensions, H x W x D	120 x 240 x 250 mm (4.7 x 9.4 x 9.8 in)

FISO Signal Conditioners

The FPIâ€“LS series conditioners are compatible with the FISOâ€“LS pressure catheters. The technique used internally to transmit and receive the light signal allows for continuous sensing that does not rely on light pulses.

Item No.	Description
75-0704	FISO FPI-LS Signal Conditioner, Single Channel, 15 kHz Analog Output

DETAILS

The FPI–HR series conditioners are compatible with the fiber optic temperature catheters. The FPI–LS series conditioners are compatible with the FISO–LS pressure catheters. The technique used internally to transmit and receive the light signal allows for continuous sensing that does not rely on light pulses. Since no light is pulsed there is no need for a minimum catheter length as with previous fiber optic sensors. A built–in fan keeps the signal conditioners from overheating or burning out the unit. RS–232/RS–485 Digital Output onboard as well as a 0 to 5 V analog output. An analog output cable is supplied with a BNC connector to interface with common data acquistion systems.

HSE Multi Sensor Amplifier

The HSE Multi Sensor Amplifier is designed for measurement applications in animal experimental research or other technical uses.

It is equipped with three measurement ranges for optimal performance. It is factory calibrated to an HSE sensor (transducer) ordered at the same time. Sensors from other vendors can also be used.

Each Multisensor Amplifier Includes:

- HSE Universal Multi Sensor Amplifier
- Multirange power supply incl. cable
- BNC cable 2m length
- Screwdriver to adjust display brightness
- User´s manual (operating instructions)

Item No.	Description
73-5078	HSE Multi Sensor Amplifier, for HSE Sensors
73-5071	HSE Multi Sensor Amplifier, Custom Version
73-4479	Manual Pressure Calibrator, Range 0-300 mmHg

DETAILS

The HSE Multi Sensor Amplifier is designed for measurement applications in animal experimental research or other technical uses in general laboratory, light industrial or office environments.

Features

- Amplification of sensor signals measuring, for example, pressure, force or displacement
- Three measurement range settings. These can be used for low, mid and high measurement ranges for one specific sensor. Or you can use three different sensors without the need to change gain settings as long as there are no jumper changes needed.
- Internally pre-set gain for each range, eliminating the possibility of unintended gain change leading to issues comparing repeating measurement
- Zero adjustment over full measurement range
- Bright display of measurement values, adjustable contrast
- Analog output Â±5 V for range maximum
- Output voltage adjustment for analog output signals
- Serial output of measurement values via USB port

The amplifier system is based on a resistance full bridge circuit. It is available ready to use, i.e., set and calibrated to one of the HSE sensors or those of other suppliers. If using other sensors, there may be different connection cables available. The amplifier is factory calibrated to the sensor if both are ordered together.

The HSE Multi Sensor Amplifier is equipped with three measurement ranges for optimized performance. Each of these represent a separate gain setting, which can be changed internally by positioning jumpers, according to the sensor selected. Setting these gains internally ensures that no unintended change of gain settings, for example on front panel turning knobs, can influence repetitive accuracy of the measurement values.

Compatible Transducers & Measurment Ranges

Sensor	**Low**	**Mid**	**High**	**Units**
Pressure				
APT300	0 to 50	0 to 200	0 to 400	mmHg
P75	0 to 20	0 to 50	0 to 75	mmHg
DLP2.5	-	-	2.5	cmH2O
MPX	0 to 30	0 to 60	0 to 100	cmH20
Millar SPR-x	0 to 50	0 to 200	0 to 400	mmHg
Force				
FT20	0 to 5	0 to 10	0 to 20	cN
FT50	0 to 10	0 to 25	0 to 50	cN
FT300	0 to 100	0 to 200	0 to 300	cN
K30	0 to 5	0 to 15	0 to 30	cN
K100	0 to 20	0 to 50	0 to 100	cN
K300	0 to 100	0 to 200	0 to 300	cN
K1000	0 to 200	0 to 500	0 t0 1000	cN

SPECIFICATIONS

Sensor Input	6-pin socket with screw lock (Binder, Amphenol, Tuchel)
Measurement Range	3 selectable ranges depending on used sensor and desired measurement range
Analog Signal Output	BNC socket Â±5 V
Dimensions (H x W x D)	5 cm x 16.5 cm x 12 cm

Weight	0.8 kg
Power	Wide range power supply 110 to 230 V, exchangeable plug adapters for EU, USA, CHINA, UK
Operating Temperature	4Â°C to 40Â°C (40Â°F to 104Â°F)
Storage Temperature	10Â°C to 70Â°C (14Â°F to 158Â°F)
Operating Humidity	20% to 80% RH, non-condensing
Mode of Operation	Continuous
Classification	Class II
Pollution	IP2X
Installation	Category II

Contact ECG Electrode, Silver Chloride Pellet

Contact ECG Electrode, Silver Chloride Pellet

Item No.	Description
73-0200	Contact ECG Electrode, Silver Chloride Pellet

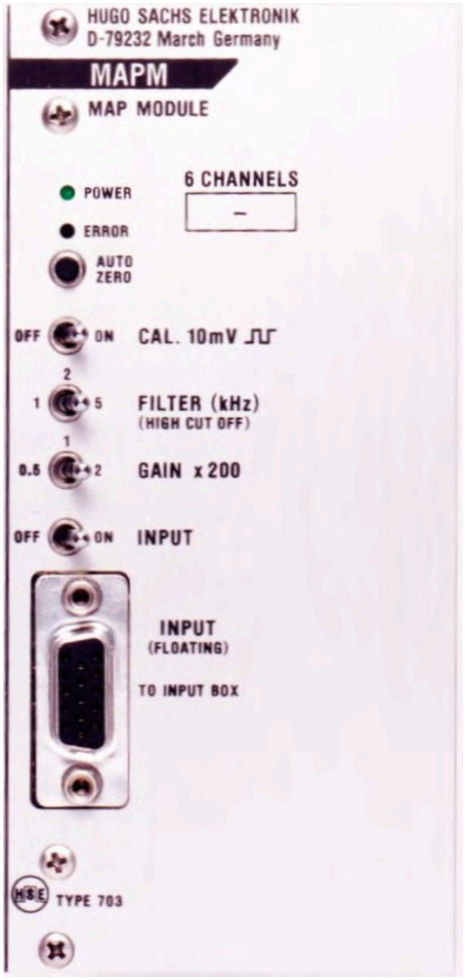
DETAILS

Contact ECG Electrode, Silver Chloride Pellet

PLUGSYS Monophasic Action Potential Module (MAPM)

Use for capturing and amplifying monophasic action potentials (MAPs)

Item No.	Description
73-1780	Monophasic Action Potential Module (MAPM), 6-Channel
73-1787	Input Box for up to 6 MAP Channels, for 1 PLUGSYS MAPM Module, with Connection Cables



DETAILS

The **Monophasic Action Potential Module** (MAP) is for capturing and amplifying monophasic action potentials (MAPs) in the PLUGSYS system. It has to be connected to special MAP electrodes. This module incorporates isolated input amplifiers in order to avoid hum interference. In this way the inputs are isolated electrically from the output circuits and from the housing.

The output voltages of the amplified MAP signals can be switched with jumpers to the PLUGSYS system bus. From the system bus they can be picked off by a Recorder Output Module (ROM) for direct recording or a DAQ Hardware PLUGSYS for data acquisition by computer. A square-wave calibration generator with a 10 mV amplitude is incorporated for calibrating the amplitudes.

Inputs: A special connection box is required for connecting the MAP electrodes, with separate switch-off facility for the individual channels. The connection box has to be placed close to the electrodes so that the unscreened electrode leads can be kept as short as possible. The box is not part of the module and has to be ordered separately.

SPECIFICATIONS

Specifications	**73-1780**	**73-3080**
Amplifier Type	DC amplifier with automatic zeroing, 6 channels	DC amplifier with automatic zeroing, 6 channels
Calibration	Square-wave signal 10 mV 2 Hz	Square-wave signal 10 mV 2 Hz
Commond Mode Rejection	Better than 1 in 50,000 at 50 Hz	Better than 1 in 50,000 at 50 Hz
Connector	96-pin VG connector to DIN 41612 submin-D 15-HD	96-pin VG connector to DIN 41612 submin-D 15-HD
Filter	Low-pass filter: 1 kHz, 2 kHz and 5 kHz	Low-pass filter: 1 kHz, 2 kHz and 5 kHz
Gain	Setting x0.5 - 100; Setting x1 - 200; Setting x2 - 400	Setting x0.5 - 100; Setting x1 - 200; Setting x2 - 400
Input Box	(Order separately) input box with 6 differential inputs, sockets suitable for 2 mm dia. plug pins, including approx. 2 m connecting cable	(Order separately) input box with 6 differential inputs, sockets suitable for 2 mm dia. plug pins, including approx. 2 m connecting cable
Input Circuit	Differential inputs, isolated (floating input), isolating voltage 200 V DC max.	Differential inputs, isolated (floating input), isolating voltage 200 V DC max.
Input Impedance	When switched on (INPUT ON): 1010Ω When switched off (INPUT OFF): 5000Ω approx.	When switched on (INPUT ON): 1010Ω When switched off (INPUT OFF): 5000Ω approx.

Specifications	73-1780	73-3080
Output	Output signals of 6 MAP signals are linked by jumpers to PLUGSYS bus system; link to display unit is provided by Recorder Output Module (ROM) installed in PLUGSYS system	Output signals of 6 MAP signals are linked by jumpers to PLUGSYS bus system; link to display unit is provided by Recorder Output Module (ROM) installed in PLUGSYS system
PLUGSYS Width*	3 slot units	3 slot units
Power Supply	5 V 1.2 mA from PLUGSYS system bus	5 V 1.2 mA from PLUGSYS system bus
Zeroing	Voltage range	Voltage range

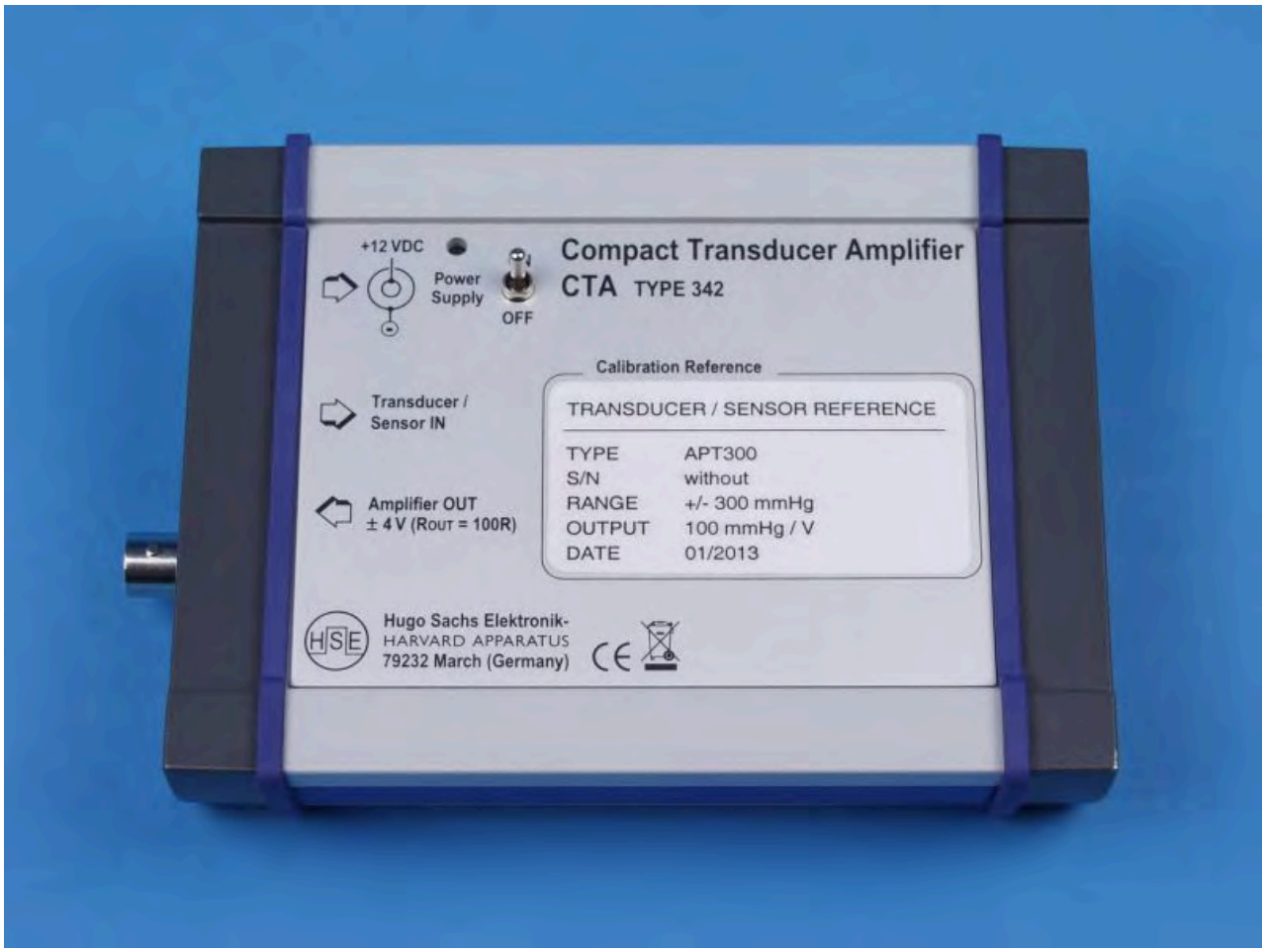
Compact Transducer Amplifier

Compact Transducer Amplifier

The Compact Transducer Amplifier (CTA) is a DC bridge-based transducer amplifier and signal conditioner for HSE PLUGSYS Transducers. It can be used with pressure, force, displacement or other bridge-based transducers. See the Item List and Details Section for the compatible list of transducers. It is factory adapted and calibrated for use with a specific transducer model. Once configured it cannot be modified for use with any other transducer. The CTA and transducer must be ordered together. Please see our Multi-Sensor Amplifier if you intend to use the amplifier for multiple transducer types or you require a digital display of average values.

Item No.	Description
73-4457	Compact Transducer Amplifier, Universal Power Supply, with EU Power Cord
73-4460	Compact Transducer Amplifier, Universal Power Supply, with US Power Cord
73-3862	APT300 Pressure Transducer for PLUGSYS Modules (73-0065, 73-1793) or CTA Compact Transducer Ampllifier (73-4457)
73-0020	P75 Venous Pressure Transducer for PLUGSYS Modules (73-0065, 73-1793) or CTA Compact Transducer Ampllifier (73-4457)
73-4479	Manual Pressure Calibrator, Range 0-300 mmHg
73-3882	Differential Low Pressure Transducer DLP2.5, range +- 2.5 cmH2O, HSE Connector
73-0064	Differential Pressure Transducer MPX, Range +- 100 cmH2O, HSE Connector
73-4986	FT20 Isometric Force Transducer ± 20 g, includes 6 Pin DIN cable for HSE amplifiers

Item No.	Description
73-4987	FT50 Isometric Force Transducer ± 50 g, includes 6 Pin DIN cable for HSE amplifiers



DETAILS

The Compact Transducer Amplifier (CTA) is a DC bridge-based transducer amplifier and signal conditioner for HSE PLUGSYS Transducers. It can be used with pressure, force, displacement or other bridge-based transducers. See the Item List and Details Section for the compatible list of transducers. It is factory adapted and calibrated for use with a specific transducer model. Once configured it cannot be modified for use with any other transducer. The CTA and transducer must be ordered together. Please see our if you intend to use the amplifier for multiple transducer types or you require a digital display of average values.

It comes with a power supply suitable for all countries (90 to 264 V). The CTA powers the selected transducer (excitation voltage 5 V), amplifies the signal and outputs a signal voltage (range ±4 V). Trimmer adjustments are available for gain (30 to 100%) and zero offset.

The CTA analog output signal can be input to a suitable data acquisition system or other device (e.g. the syringe pump) that can accept a high-level signal in the range of ±4 V.

The CTA includes: enclosed amplifier, power supply with country either a EU or US mains cable (power cord)*, HSE transducer adapter cable, one BNC-BNC output cable (length 2 m), operating instructions.

Compatible Transducers:

ItemNo	Description
	PRESSURE TRANSDUCER APT300 FOR HSE PLUGSYS AMPLIFIERS, RANGE -300 TO 300mmHg WITH 6 PIN HSE CONNECTOR (73-2909) CABLE LENGTH 3m (10ft)[A]
	LOW RANGE BLOOD PRESSURE TRANSDUCER P75 FOR HSE PLUGSYS MODULE [A]
	Manual Pressure Calibrator, Range 0-300 mmHg[A]
	Differential Low Pressure Transducer DLP2.5, range +- 2.5 cmH2O, HSE Connector
	Differential Pressure Transducer MPX, Range +- 100 cmH2O, HSE Connector[A]
	FT20 ISOMETRIC FORCE TRANSDUCER +/- 20g FOR HSE AMPLIFIER CABLE INCLUDED
	FT50 ISOMETRIC FORCE TRANSDUCER +/- 50g FOR HSE AMPLIFIER CABLE INCLUDED

Please see our complete line of .

Data Acquisition Hardware and Software

Please see our complete line of Solutions for Physiologic signals if you need to monitor and record the signal output.

SPECIFICATIONS

Frequency Response	DC - 1500 Hz
Transducer Excitation Voltage	5 VDC, 100 mA max , Ri = 10 â„¦
Output Voltage Range	±4 V
Gain	1 to 1000, factory adapted to the transducer Gain variable 30 to 100% fine adjustment with trimmer
Zero Offset	Manually adjustable with trimmer
Power Supply	External power supply Input voltage 100 to 240 VAC, 50/60 Hz Output voltage 12 VDC/300mA
Power Consumption	100 mA max.

HSE Data Acquisition Hardware

Choose from one of three available data acquisition hardware interfaces. The stand-alone version (73-3330) is ideal for applications that require collection of data from both PLUGSYS modules or third party analog output devices. The PLUGSYS 8 (73-4817) or 16 (73-4818) channel hardware interfaces are convenient compact data acquisition hardware interfaces for the PLUGSYS .

Item No.	Description
73-4818	USB-C Data Acquisition Module for PLUGSYS, 16 Channels
73-4817	USB-C Data Acquisition Module for PLUGSYS, 8 Channels
73-3330	Data Acquisition Hardware, USB Universal Stand Alone Version

DETAILS

Central connection for output signals of PLUGSYS modules to data acquisition board

73-4817 USB-C PLUGSYS module has an 8-channel A/D converter on board. Amplifiers are in the housing internally connected to the A/D channels. Output to computer is USB.

73-4818 USB-C PLUGSYS module has a16-channel A/D converter on board. Amplifiers are in the housing internally connected to the A/D channels. Output to computer is USB.

To connect input signals from any instrument with analog output to a computer or laptop via an USB port for using HA-HSE software

Consists of a 16-channel USB A/D converter box with BNC inputs and one USB cable. Up to 16 input signals can be connected to the USB Input Box from the PLUGSYS system case or independent manufacturers via BNC cables. The USB Input Box is connected to a standard USB 2.0 port on thedesktop or laptop computer.

SPECIFICATIONS

Consists of a 16-channel USB A/D converter box with BNC inputs and one USB cable.

TRO Isotonic Research Transducer

The TRO isotonic transducer measures displacements with pre-adjusted loads (position transducer).

Parameters Measured:

- Changes in muscle length under constant load

Components Included:

- Transducer
- Specifications Sheet
- Calibration Certificate

Item No.	Description
76-0423	Isotonic research transducer for ADInstruments bridge amp
76-0424	Isotonic research transducer for PLUGSYS TAM amplifier

Isotonic Research Transducer

DETAILS

The TRO isotonic transducer measures displacements with pre-adjusted loads (position transducer). Isotonic transducers are classically used for measuring the contraction amplitude of isolated muscles in organ bath studies, i.e. the changes in tissue length observed under constant load. These transducers are preferably used with smooth muscle preparations characterized by relatively slow contractions (ileum, vas deferens, lung strips, esophagus, urinary bladder, etc.)

Parameters Measured:

- Changes in muscle length under constant load

Components Included:

- Transducer
- Specifications Sheet
- Calibration Certificate

SPECIFICATIONS

Range	5 mg to 5 g
Resolution	5 mg
Displacement	±15° (48 mm)
Sensitivity (full range)	300 mV
Excitations	5 - 10V DC
Element Resistance	1000 W
Counterweight Graduation	Five 1 g div. with 250 mg subdiv.

Isometric Force Transducers, TRI Series

TRI Series Force Transducers (isometric) measure the force of contraction of isolated tissues under conditions of constant force.

Item No.	Description
76-0418	Isometric Transducer TRI201 for PLUGSYS TAM Amplifier
76-0098	Isometric Transducer TRI210A for ISO510 Amplifier

DETAILS

TRI Series Force Transducers (isometric) measure the force of contraction of isolated tissues under conditions of constant force. Isometric Transducers are classically used in Organ Bath experiments with muscles with short/rapid contractions such as tracheal muscle, atrium, papillary muscle, aortic rings, veins or other vessel rings.

The Transducers are equipped with a special system allowing an easy and rapid fixation of the thread that tightens upper side of the tissue in an organ bath. TRI Series Transducers are appropriate for various load ranges from simple applications to those requiring detection of very small forces.

Parameters Measured

- Muscle contraction force

Components Included

- Transducer
- Specifications sheet
- Calibration certificate

SPECIFICATIONS

TRI201:	High performance 5 mg to 25 g; Transducer Range
Resolution	2 mg; Displacement: ± 0.45 mm
Sensitivity (full range)	30 mv/V; Excitations: 5-10V AC/DC
Element Resistance	full bridge 360 W
TRI202P-TRI 203P:	Very high sensitivity Transducer for small forces
Range	0 mg to 25 g (TRI 203P: up to 50 g)
Resolution	infinite
Displacement	± 0.03 mm
Sensitivity	(full range): 100 mv/V
Excitations	5-10V AC/DC
Element Resistance	full bridge 720 W
TRI210:	Teaching Force Transducer
Range	10 mg to 25 g
Resolution	5 mg
Displacement	± 0.5 mm
Sensitivity	(full range): 20 mv/V

Excitations	5-10V AC/DC
Element Resistance	full bridge 360 W

Disposable Foam Electrode

Ag/AgCl high chloride wet gel disposable foam electrode for fast, clear traces

Item No.	Description
72-7095	Disposable Foam Electrode, 38 mm (1 1/2 in) diameter, pkg of 60 (5 electrodes per strip)

DETAILS

Ag/AgCl high chloride wet gel for fast, clear traces

- For active subjects, no movement artifact

- Latex free/hypoallergenic
- Package of 60 (5 per strip)

SPECIFICATIONS

Specifications	72-7095
Diameter (English)	1 1/2 in
Diameter (Metric)	38 mm

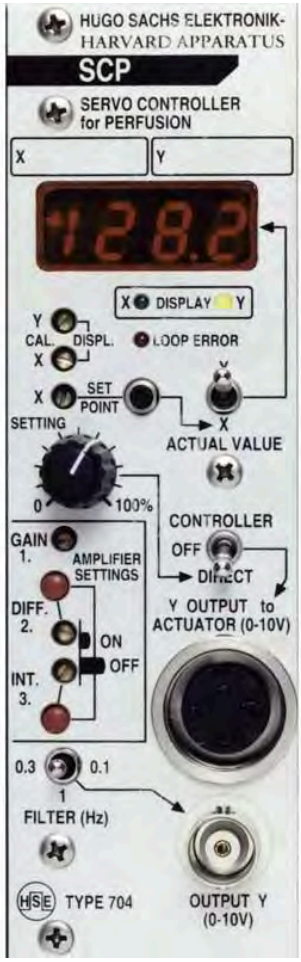
PLUGSYS Servo Controller Module (SCP) for Perfusion Pressure Regulation and Indirect Flow Measurement

The PLUGSYS SCP module is a PID pressure controller intended for perfusion control of isolated organ perfusions using a peristaltic pump. It works together with PLUGSYS bridge amplifiers TAM-A and TAM-D. The modules must be built into a housing which provides the power for the modules.

The SCP controls perfusion under constant flow or constant pressure with just one switch. It is also used for an easy and inexpensive flow measurement since the controller also calculates the perfusion flow from pump speed.

Connection cables are available to connect the SCP to different peristaltic pump.

Item No.	Description
73-2806	PLUGSYS Servo Controller for Perfusion (SCP)



DETAILS

The **Servo Controller for Perfusion** (SCP) module is used for perfusion of isolated organs by controlling the speed of a peristaltic pump. It is a PID controller which operates to maintain perfusion either at constant perfusion pressure or at constant perfusion flow. It also calculates the perfusion flow, acts as inexpensive flowmeter (also called indirect flow measurement vs the direct method using ultrasound transit time technology).

For a functioning system the following additional items are required:

- Measuring system with transducer and amplifier for perfusion pressure
- Pump suitable for external control (analog input 0 to 5 or 0 to 10 V) and providing the appropriate pumping rate
- Suitable pump tubing
- Connection cable to selected peristaltic pump
- module
- , Type 601, 603 or 607

The SCP is supplied with a connection cable to a Reglo roller pump (73-4618). Other cables can be substituted and are available on request.

Function

The built-in PID controller is used for controlling the connected peristaltic pump speed. Higher speed leads to a higher pressure in the perfused organ

In **constant flow perfusion** (DIRECT MODE) the SCP controls the pump speed. More speed more flow. Flow runs linear to pump speed.

In **constant pressure mode** the user can define a SET POINT, which is the desired pressure the organ should be perfused with. As soon you switch to the CONTROLLER mode the PID controller adjusts the pump speed so that after a few seconds the SET POINT pressure is reached and held on a constant level. If the pressure is below the SET POINT, the controller speeds up the pump. If the pressure is above the SET POINT the controller speeds down the pump. This control is running all the time in a closed loop.

Since the delivered flow rate in ml/min is running linear to the pump speed, the SCP module is able to calculate and display the flow rate directly from the pump speed. Thus the SCP is also a flowmeter. This is called **indirect flow measurement** because the flow is not directly measured but instead calculated. (Note: **Direct flow measurement** is accomplished with the module.)

The SCP also has an analog output (0 to 10 V) which corresponds to the pump speed. This output can be used for continuous flow recording using a PC-based Data Acquisition System

SPECIFICATIONS

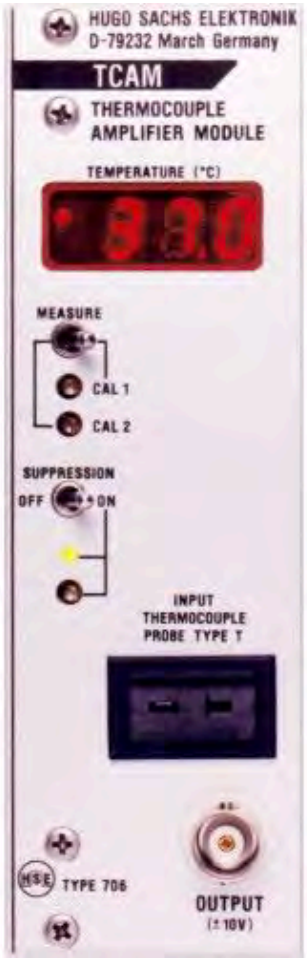
Accessories	Operating Instructions, Screwdriver, Output Cable to Pump
Actual Value Input	0 - 10 V via System Bus
Ambient Conditions	Laboratory Indoors
Connector	DIN 41612, 96-pin VG
Construction	Plug-in Module for a PLUGSYS
Control Gain	1 - 50, Adjustable
Control Voltage	0 - 10 V to Operate the Pump
Derivative Factor	0.1 - 100, Adjustable
Description	Servo Controller for Perfusion (SCP) Type 704
Digital Indication	Range -1999 to +1999, Selectable for Actual Value, Setpoint, or Control Output Signal
Function	Electronic PID Controller for Physiological and Pharmacological Research
Integral Factor	0.05 - 10, Adjustable
PLUGSYS Width*	2 slot units

Power Supply	5 V, 0.3 A from PLUGSYS
Recorder Output	0 - 10 V, BNC Socket
Setpoint	0 - 5 V, Adjustable
Weight (Metric)	0.3 kg

PLUGSYS Thermocouple Amplifier Module (TCAM)

For measuring temperature accurately with thermocouple probes

Item No.	Description
73-1792	Thermocouple Amplifier Module (TCAM)



DETAILS

The measurement of temperature on small structures requires probes of correspondingly small dimensions. With the **Thermocouple Amplifier Module** (TCAM) and a suitable thermocouple, there are virtually no limitations.

(Type T, copper constantan) are available in a wide range of forms. From the thinnest wires with a diameter of 0.23 mm (IT-23) to the largest rectal probe with 4 mm probe diameter (RET-1); a whole range of probes in different forms and dimensions can be supplied. The temperature probes are directly interchangeable and do not require individual calibration.

The range of the TCAM module covers 0°C to 100°C. In the physiological temperature range (30 to 45°C) the basic accuracy is 0.1°C; outside this range the accuracy is 0.2°C.The built-in digital display has a resolution of 0.1°C.

The TCAM module has an analogue output for connection to a recorder or data acquisition system. The recorder or acquisition system can easily be calibrated through a build-in simulation device with two adjustable temperature values. In addition, there is a zero suppression facility for recorders which permits recording temperatures within a limited range (e.g., 36 to 38°C) at a high resolution.

SPECIFICATIONS

Analog Output	For simultaneous recording using BNC connector on front panel
Calibration	2-point calibration with two freely selectable temperatures
Connector	DIN 41612, 64-pin VG
Display	3-1/2 digit LED display
Input	Floating differential input, max. isolation 1500 Vrms, transient protection to ANSI/IEEE C37.90. 1-1989, input protection to 240 VAC continuous
Input Connector	Thermoelement connector blue, Cu/CuNi Range 0 to 100°C
Resolution	0.1°C Sensitivity 0.1°C in physiologic range between 30° and 45°C; 0.2°C outside this range
Response Time	0.2 sec (90% span)
PLUGSYS Width	2 slot units

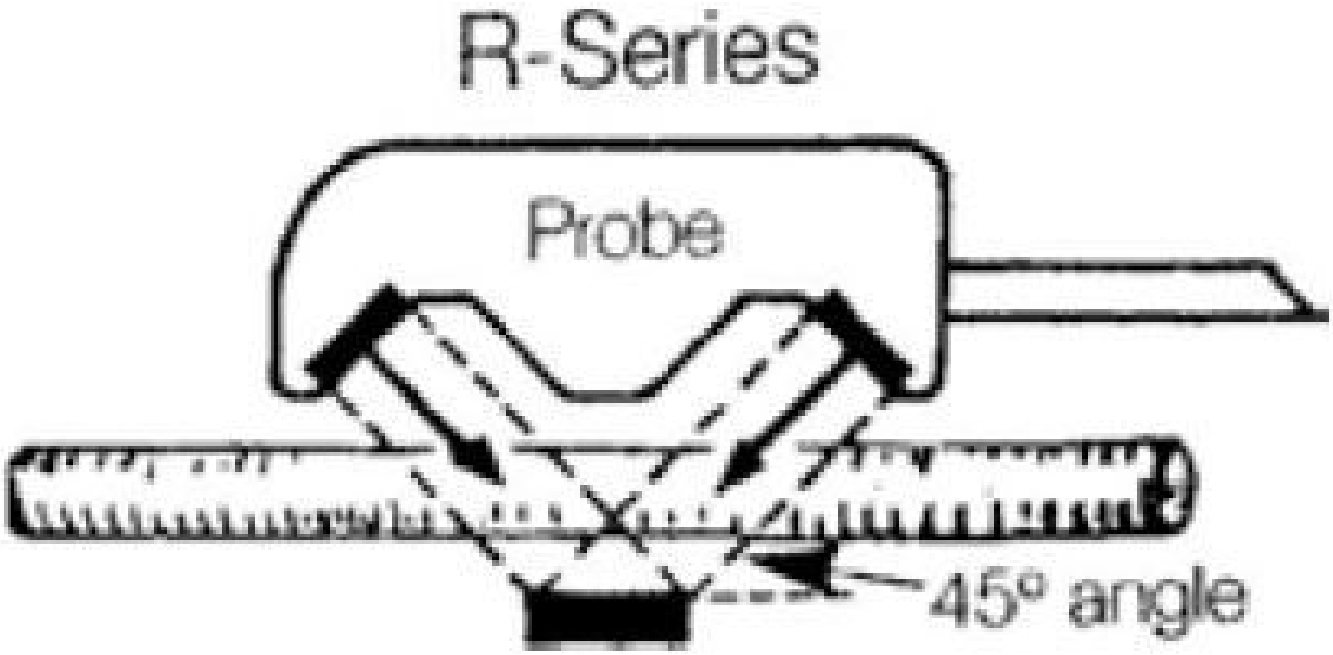
Standard Flow Probes (R-Series - J Reflector)

Limited available quantities. Please contact us for further information.

For direct measurement of volume flow for vessels from 1 to 1.5 mm diameter using the PLUGSYS transit time flow meter module (. These probes have the transducers positioned at an 45° angle to the vessel. The probes are available with the cable exit in the back or on the side.

For information on flow probes to interface with the earlier versions of the TTFM (73-0146) please contact Technical Services.

Item No.	Description
73-4669	MA1PRS Flow probe for HSE TTFM-2 or TS420 module
73-4670	MA1.5 PRB Flow probe for TTFM-2 or TS420 Module



DETAILS

For direct measurement of volume flow for vessels from 1 to 1.5 mm diameter using the PLUGSYS transit time flow meter module (. These probes have the transducers positioned at an 45° angle to the vessel. The probes are available with the cable exit in the back or on the side.

Coding:

- RB: R-probe with cable exit in the Back
- RS: R-probe with cable exit on the Side

All R Probes do have a J reflector with slide cover.

For information on flow probes to interface with the earlier versions of the TTFM (73-0146) please contact Technical Services.

SPECIFICATIONS

Item Number	**73-4668**	**73-4669**	**73-4670**
Diameter	1 mm	1 mm	1.5 mm
OD Vessel Acute	0.7 - 1.2	0.7 - 1.2	1.2 - 1.8
Resolution ml/min	0.05	0.05	0.075
Range ml/min Sc. Low	5	5	10
Sc. Norm	20	20	40
Max	100	100	200
Probe Length	6.5 mm	6.5 mm	7.6 mm
Probe Width	4 mm	4 mm	3.5 mm
Cable Length	60 cm	60 cm	60 cm
Cable Exit	Back	Side	Back

Sterile Disposable Pressure Transducer (DTXPlus)

Minimize distortion in the pressure waveform and maximize accuracy.

- Individually packaged, sterile, disposable blood pressure transducers
- Five-year shelf life
- Stopcocks must be purchased separately
- Class III according to European Medical Devices Directive 93/42/EEC

Item No.	Description
72-4297	DTXPlus Sterile Disposable Single-Use Transducer, pkg. of 10, with Hugo-Sachs PLUGSYS Interface Cable
72-4292	Replacement DTXPlus Disposable Single-Use BP Transducer, pkg. of 10 (Interface Cable not included)
72-2883	Interface Cable, 12 ft (3.7 m), Universal Connector to Tinned Leads (no connector), For Use with Other Equipment, Mating Connector Required
73-4479	Manual Pressure Calibrator, Range 0-300 mmHg

DETAILS

DTXPlus blood pressure transducers minimize distortion in the pressure waveform and maximize accuracy.

- Individually packaged, sterile, disposable blood pressure transducers
- Five-year shelf life
- Stopcocks must be purchased separately
- Class III according to European Medical Devices Directive 93/42/EEC

Transducer Item #	**Interface Cable**
72-4293	HAI
72-4297	PUGSYS TAM
72-4294	Grass Amplifiers
72-4295	PROPAQ

SPECIFICATIONS

Pressure Range	-30 to +300 mmHg
Over Pressure Tolerance	-700 to +7,800 mm
Frequency Response	>1,200 Hz, 15 bandwidth shall be >200 Hz
Transducer Excitation	1 to 10 V RMS
Transducer Excitation Input Impedance	1,100 to 3,450 Ω
Transducer Signal Output Impedance	270 to 330 Ω
Nominal Sensitivity (gain)	5 µV/V/mmHg
Unbalance (Zero Balance)	±40 mmHg
Accuracy	2% of the reading or ±1 mmHg, whichever is greater over the operating range
Operating Temperature	15° to 40°C

Standard Flow Probes (S-Series - L Reflector)

Limited available quantities. Please contact us for further information.

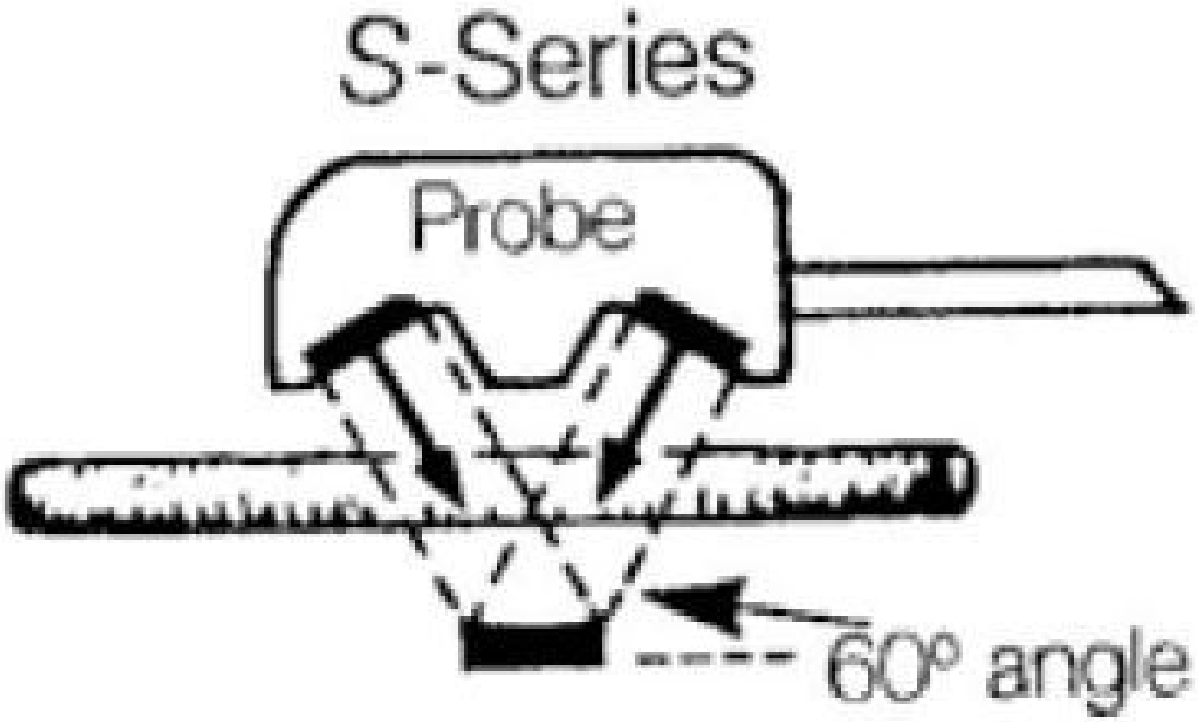
For direct measurement of volume flow for vessels from 2 to 20 mm diameter using the PLUGSYS transit time flow meter module ().

These probes have the transducers positioned at an 60° angle to the vessel. This reduces the flow probe body size and reflector width for placement of the probe in applications where space is limited. These probes are available with the cable exit in the back or on the side.

For information on flow probes to interface with the earlier versions of the TTFM (73-0146) please contact Technical Services.

Item No.	Description
73-4643	MA1.5 PSL Flow probe for HSE TTFM-2 or TS420 module
73-4646	MA2PSS Flow probe for HSE TTFM-2 or TS420 module
73-4648	MA2.5PSS Flow probe for HSE TTFM-2 or TS420 module
73-4649	MA2.5PSL Flow probe for HSE TTFM-2 or TS420 module
73-4651	MA3PSS Flow probe for HSE TTFM-2 or TS420 module
73-4653	MA4 PSS Flow probe for HSE TTFM-2 or TS420 module
73-4655	MA6 PSS Flow probe for HSE TTFM-2 or TS420 module
73-4657	MA8PSS Flow probe for HSE TTFM-2 or TS420 module

Item No.	Description
73-4658	MA10PSB Flow probe for HSE TTFM-2 or TS420 module
73-4659	MA10PSS Flow probe for HSE TTFM-2 or TS420 module
73-4661	MA12PSS Flow probe for HSE TTFM-2 or TS420 module
73-4662	MA14PSB Flow probe for HSE TTFM-2 or TS420 module
73-4663	MA14PSS Flow probe for HSE TTFM-2 or TS420 module
73-4664	MA16PSB Flow probe for HSE TTFM-2 or TS420 module
73-4665	MA16PSS Flow probe for HSE TTFM-2 or TS420 module
73-4666	MA20PSB Flow probe for HSE TTFM-2 or TS420 module
73-4667	MA20PSS Flow probe for HSE TTFM-2 or TS420 module



DETAILS

For direct measurement of volume flow for vessels from 2 to 20 mm diameter using the PLUGSYS transit time flow meter module ().

These probes have the transducers positioned at an 60° angle to the vessel. This reduces the flow probe body size and reflector width for placement of the probe in applications where space is limited. These probes are available with the cable exit in the back or on the side. (Photo shows side exit.)

Coding:

- SB: S-probe with cable exit in the Back
- SS: S-probe with cable exit on the Side

Probe diameters between 2 and 2.5 mm do have a J reflector with slide cover
Probe diameters between 3 and 20 mm do have a L reflector with slide cover

For information on flow probes to interface with the earlier versions of the TTFM (73-0146) please contact Technical Services.

SPECIFICATIONS

Diameters 3 mm - 6 mm

Item Number	**73-4650**	**73-4651**	**73-4652**	**73-4653**	**73-4654**	**73-4655**
Diameter	3 mm	3 mm	4 mm	4 mm	6 mm	6 mm
OD Vessel Acute	2.5 - 3.7	2.5 - 3.7	3.3 - 4.4	3.3 - 4.4	4.4 - 6.6	.4.4 - 6.6
Resolution ml/min	0.4	0.4	0.8	0.8	2.2	2.2
Range ml/min Sc. Low	50	50	100	100	50	50
Sc. Norm	200	200	400	400	1 L	1 L
Max	1 L	1 L	2 L	2 L	5 L	5 L
Probe Length	9 mm	9 mm	13.3 mm	13.3 mm	13.5 mm	13.5 mm
Probe Width	5 mm	5 mm	6 mm	6 mm	6.7 mm	6.7 mm
Cable Length	100 cm	100 cm	100 cm	100 cm	100 cm	100 cm
Cable Exit	Back	Side	Back	Side	Back	Side

Diameters 8 mm - 12 mm

Item Number	**73-4656**	**73-4657**	**73-4658**	**73-4659**	**73-4660**	**73-4661**
Diameter	8 mm	8 mm	10 mm	10 mm	12 mm	12 mm
OD Vessel Acute	6.6 - 8.8	6.6 - 8.8	8.3 - 11.0	8.3 - 11.0	9.8 - 13	9.8 - 13
Resolution ml/min	4	4	8	8	8	8
Range ml/min Sc. Low	500	500	500	500	1L	1L
Sc. Norm	2 L	2 L	2 L	2 L	4 L	4 L
Max	10 L	10 L	10 L	10 L	20 L	20 L
Probe Length	18.8 mm	18.8 mm	18.7 mm	18.7 mm	22.5 mm	22.5 mm
Probe Width	7.5 mm	7.5 mm	8.5 mm	8.5 mm	8.5 mm	8.5 mm
Cable Length	100 cm	100 cm	100 cm	100 cm	100 cm	100 cm
Cable Exit	Back	Side	Back	Side	Back	Side

Diameter 14 mm - 20 mm

Item Number	**73-4662**	**73-4663**	**73-4664**	**73-4665**	**734666**	**73-4667**

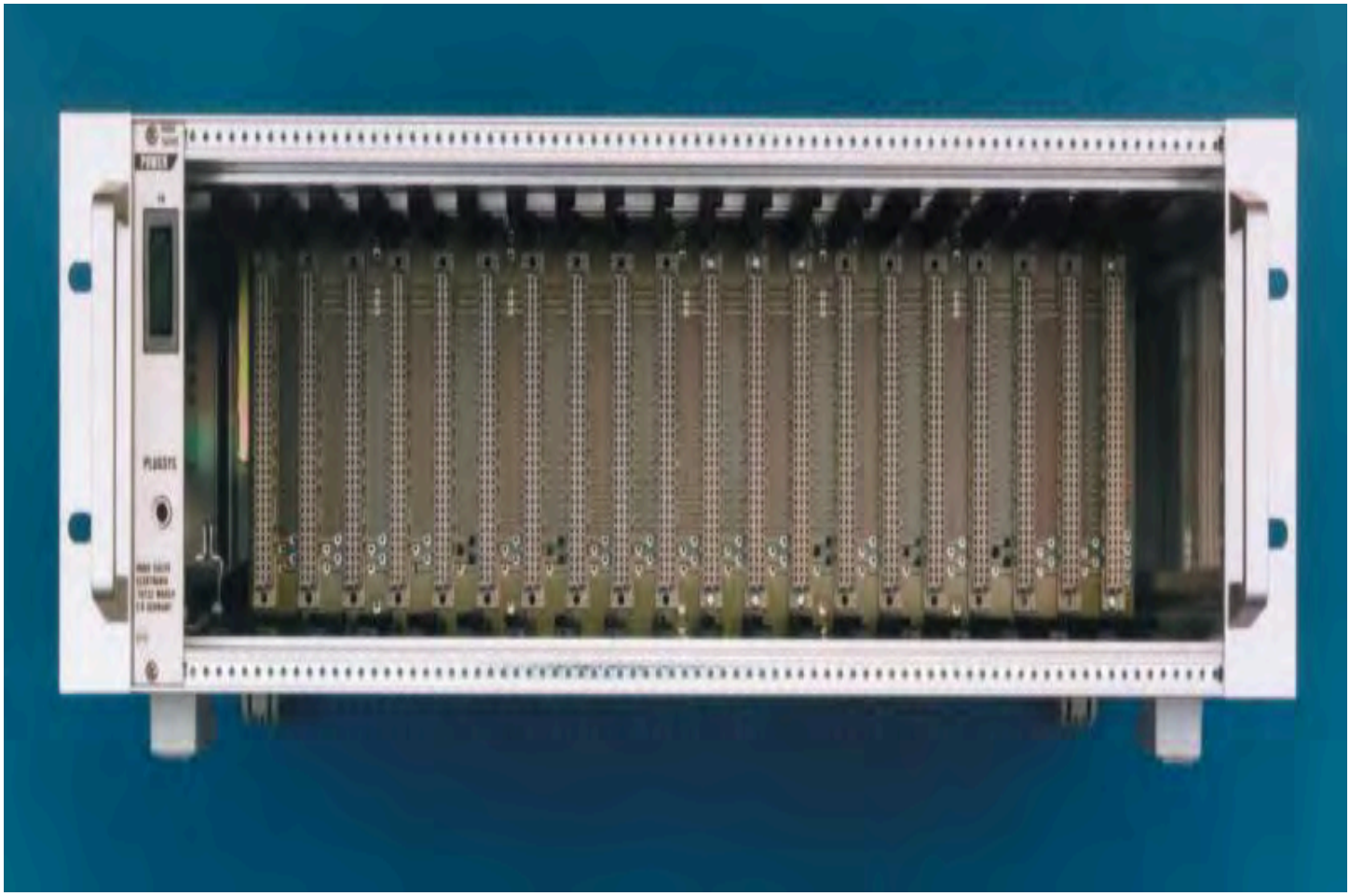
Diameter	14 mm	14 mm	16 mm	16 mm	20 mm	20 mm
OD Vessel Acute	11.3 - 15.0	11.3 - 15.0	13.3 - 17.7	13.3 - 17.7	16.0 - 21.0	16.0 - 21.0
Resolution ml/min	16	16	20	20	40	40
Range ml/min Sc. Low	1 L	1 L	2.5 L	2.5 L	2.5 L	2.5 L
Sc. Norm	4 L	4 L	10 L	10 L	10 L	10 L
Max	20 L	20 L	50 L	50 L	50 L	50 L
Probe Length	26.2 mm	26.2 mm	36 mm	36 mm	31 mm	31 mm
Probe Width	8.5 mm	8.5 mm	10 mm	10 mm	9 mm	9 mm
Cable Length	100 cm	100 cm	100 cm	100 cm	100 cm	100 cm
Cable Exit	Back	Side	Back	Side	Back	Side

PLUGSYS Case Type 603

Case Type 603 is a 19-inch rack housing and has 20 positions (slot units) to accept PLUGSYS modules. An additional power supply (73-1529) is also available, necessary only for some modules.

These basic system cases with internal system bus are supplied completely wired and ready for use.

Item No.	Description
73-0045	PLUGSYS Case, Type 603



DETAILS

The basic system cases with internal system bus are supplied completely wired and ready for use. The Type 603 cases provides a total space of 20 positions (slot units) to accept PLUGSYS modules. An additional 24 V power supply (73-1529) is also available, necessary only for some modules.

The width of the actual PLUGSYS modules equals either one or a multiple of slot units. For instance, the width of the Transducer Amplifier Module TAM-A is equal to two slot units, therefore it would occupy two slot spaces in the PLUGSYS case. The maximum number of PLUGSYS modules — such as a Transdcuer Amplifier Module, ECG Amplifier Module, Transit Time Flowmeter Module etc. — which can be plugged into a unit system case depends on the number of slot units required by each module.

SPECIFICATIONS

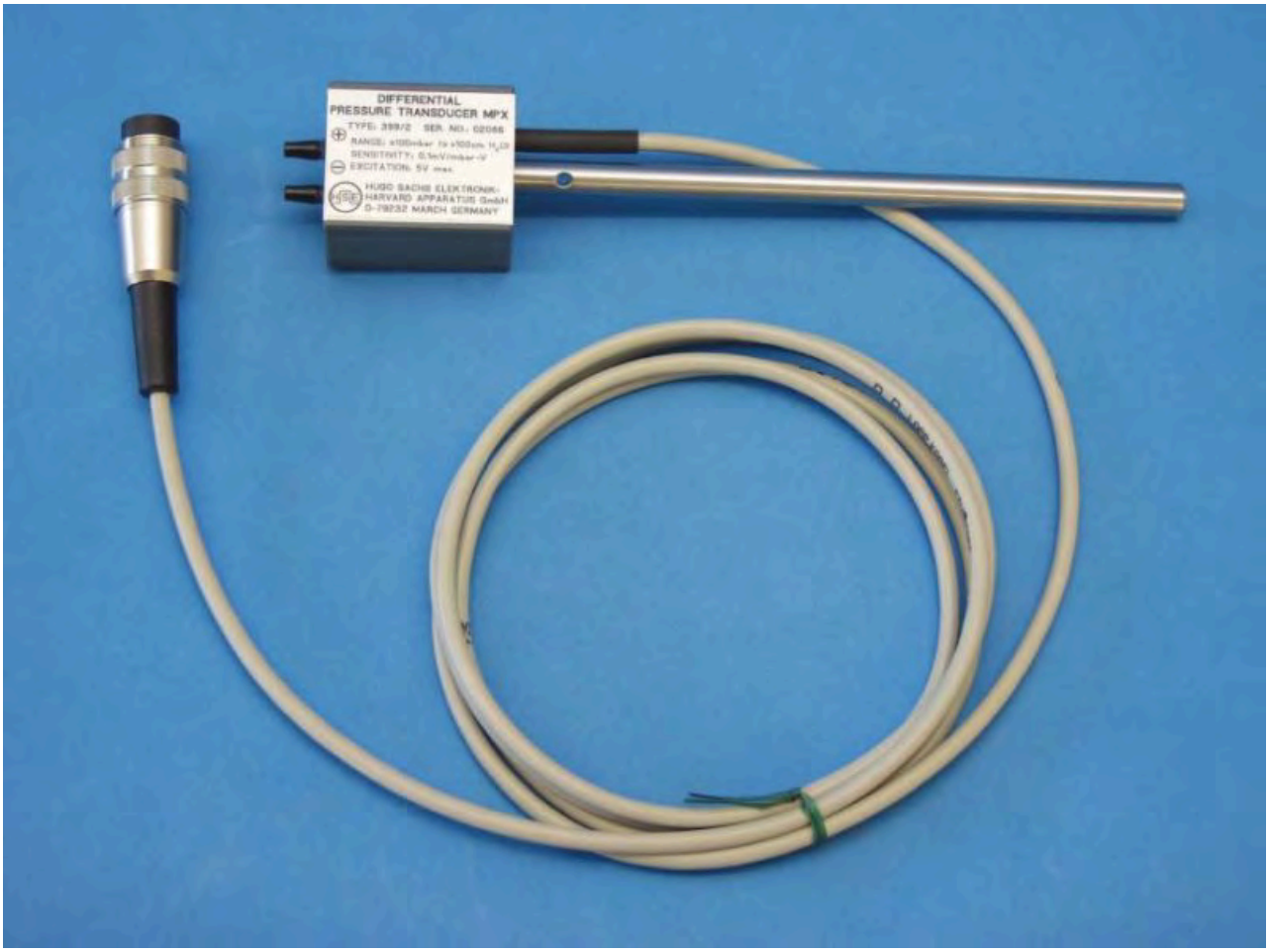
Specifications **73-0045**

Accessories	Line Cable, Spare Fuses, Screw driver for fitting Function Modules, Document Folder for Operating Instructions of Function Modules, 3 x BNC-BNC Output lines
Dimensions (H x W x D) English	5.2 x 19 x 17.1 in
Dimensions (H x W x D) Metric	132 x 483 x 435 mm
Housing Construction	Metallic housing, gray plastic coated, Universal 19 inch case with pivoting feet, prepared for rack mounting
Module Positions	20 slot units max.
Power Supply	100 to 240 VAC, 50/60 Hz, built-in line filter, 100 W max. consumption
Socket Combination	3-pin IEC mains with fuse and mains switch on back of housing
Weight (English)	14.3 lbs
Weight (Metric)	6.5 kg

Differential Pressure Transducers MPX

Ideal for measuring tracheal, esophageal or transdiaphragmatic pressures with air-filled catheter.

Item No.	Description
73-0064	Differential Pressure Transducer MPX, Range +- 100 cmH2O, HSE Connector
73-3744	Differential Pressure Transducer MPX, Range +- 100 cmH2O, for ADI Amplifier ML110 or ML112 or Newer Versions



DETAILS

These MPX Differential Pressure Transducers can be used with most research animals to measure tracheal, esophageal or transdiaphragmatic pressures with air-filled catheter. It is ideal for use with mouse, hamster, rat, guinea pig, rabbit, ferret, cat and dog.

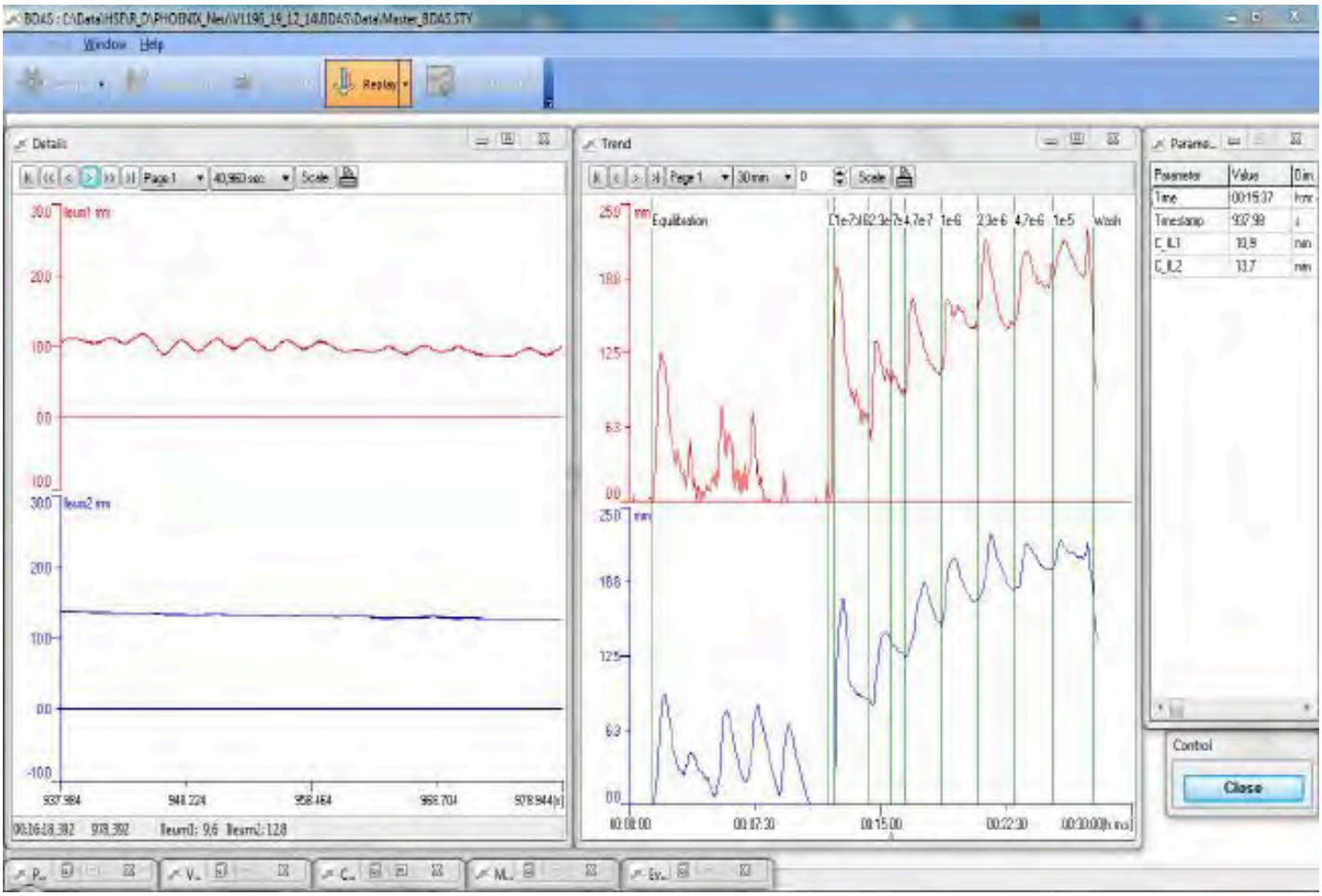
SPECIFICATIONS

Pressure Range	±100 cmH_2O (±100 mbar)
Sensitivity	0.3 to 0.8 mV/mbar, excitation of 5 V
Linearity	±1.5%
Thermal Zero Shift	5 mbar (0° to 85°C)
Input Resistance	400 to 550 â„¦
Output Resistance	600 to 1000 â„¦
Offset Voltage	1 mV maximum
Excitation Voltage	0 to 5 VDC or VAC
Overpressure	±1000 mbar (750 mmHg)
Inlet/Outlet Nozzle (ID x OD x L)	2.0 x 4.7 x 9.0 mm
Housing Size, H x W x D	24 x 42 x 36 mm (0.9 x 1.7 x 1.4 in)
Weight	190 g (6.7 oz)
Application	Only for dry air

ACAD Data Acquisition Software for Isolated Tissue Experiments

For in vitro studies on isolated tissues such as smooth muscle, and beating or electrically stimulated tissues. (Tissue bath studies)

Item No.	Description
73-4791	ACAD Data Acquisition Software for Isolated Tissue Studies for Windows



DETAILS

ACAD (Automatic Controlled Analysis of Data) is a data acquisition, monitoring and evaluation software for measurement of tissue contractions including on-line calculation of Resting Tension, Amplitude, Rate, ±dF/dt, Contraction time CT, Relaxation time RT, Response duration RD, Peak duration PD. It can be adapted to virtually any investigation using tissue bath experiments. User defined parameters can be created by formulas.

All acquired signals and all calculated parameters can be displayed in two graphic windows (Detail and Trend) according to the settings of the user. Complete raw data of experiment are stored on hard disk and can be replayed any time later after experiment. Includes graphic selection of trend data points for easy data reduction.

The ACAD software can acquire a maximum of 8 or 16 channels depending on hardware used (16 ch), (8 ch), (16 ch) or (16 ch), i.e. up to 16 different raw signals can be handled.

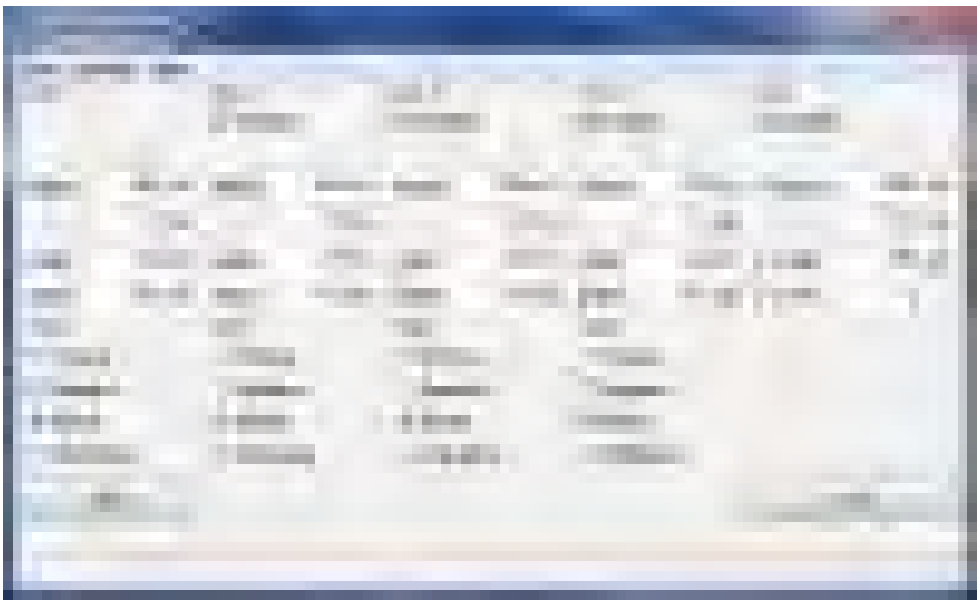
The assignment of the signals to the individual channels is determined in the menu by the user. The sample rate, the type of signals and the algorithm used for analysis are also defined by the user. The arrangement of the graphic detail (raw signals) and trend (calculated parameters) is defined in the menu.

Features

- Choose available signals to acquire and display.
- Choose from possible parameters to evaluate and display.
- Enter experimental protocol.
- Calibrate. (Calibration can be taken from previous experiment).
- Start data acquisition.

During data acqusition, all acquired signals and derived parameters are displayed on screen. All raw data and trend data are stored. Data reduction tools are included. Export of data to any statistc package are possible.

The software can also control our Programmable Stimulator Modules PSM (73-0224). Together with one or multiple Programmable Stimulator Modules and the hardware, the user can set up a 4-channel stimulator in a PLUGSYS 603 rack, for example, for electrical stimulation of four tissues in an four-channel tissue bath. Continuous Stimulation or Train Stimulation is possible.



SPECIFICATIONS

HSE-ACAD for tissue, muscles and smooth muscles calculates the following parameters:

- Resting tension
- Amplitude
- Rate, ±dF/dt
- Contraction time CT
- Relaxation time RT
- Response duration RD
- Peak duration PD

This software can be used for beating tissues and stimulated beating tissues such as atrium or papillary muscle.

It is possible to use the HA-HSE Programmable Stimulator PSM (73-0224) to trigger an external stimulator using a PPG module. Additional hardware required.

PLUGSYS Timer Counter Module (TCM)

Designed to operate in conjunction with the PLUGSYS Ventilation Control Module (VCM) used in all HSE-HA isolated lung apparatus from mice to rabbits.

Item No.	Description
73-1750	Timer Counter Module (TCM)

DETAILS

The **Timer Counter Module** (TCM) was designed to operate in conjunction with the (VCM) used in all HSE-HA isolated lung apparatus from mice to rabbits.

As a timer or event counter module it generates a signal which triggers the VCM to perform a deep inspiration cycle (sigh breath). In order to prevent the slow collapse of the isolated lung during quiet respiration, a deep inspiration should be produced every 5 to 20 minutes. This results in an appreciable extension of the lifetime of the preparation. The VCM, therefore, has a facility for triggering such a deep inspiration by pressing the 'DIRECT' key or at the regular intervals from the Timer Counter Module. Other PLUGSYS modules are also capable of responding to this output signal.

SPECIFICATIONS

Input and Output Trigger Signals	Connections made via jumpers to trigger lines of 96-pin VG connector from internal PLUGSYS system bus
Time Mode	Deep inspiration is produced at predetermined time intervals. Quartz-controlled timer inside TCM runs down from set time to '00' and then resets counter back to selected value; when '00' is reached, VCM is triggered to perform deep inspiration cycle.
Count Mode	Time or event presetting is selected on two digit thumbwheel switch (00-99) mounted on front panel; time or count range can be altered with switch SEC/MIN or x1/x10 to select appropriate factor
Preset	Time or event presetting is selected on two digit thumbwheel switch (00-99) mounted on front panel; time or count range can be altered with switch SEC/MIN or x1/x10 to select appropriate factor
Warming Function	TCM incorporates warning function which announces next triggering operation; announcement activated when internal timer or counter counts last 10 seconds or respiratory cycles; function is indicated visually on LED and audibly by built-in loudspeaker. Purpose of facility is to remind user that deep inspiration is coming shortly. This can be inhibited by pressing 'SKIP NEXT' key, if desired to avoid interference with any measurement during experiment
PLUGSYS Width	1 slot unit

PLUGSYS Case Type 601

Case Type 601 has 10 slot units for PLUGSYS modules. Most modules occupy two slots.

Note: 601 Case is shown here with four of the Transducer Amplifier Modules TAM-A (73-0065) and one ECG Amplifier module ECGA (73-0149).

Item No.	Description
73-1521	PLUGSYS Case, Type 601
73-3103	Option for +24V (1.6A) Power Supply for PLUGSYS Case Type 601

DETAILS

The basic system cases with internal system bus are supplied completely wired and ready for use. The Type 601 cases provides a total space of 10 positions (slot units) to accept PLUGSYS modules. An additional 24 V power supply (73-3103) is also available, necessary only for some modules.

The width of the actual PLUGSYS modules equals either one or a multiple of slot units. For instance, the width of the Transducer Amplifier Module TAM-A is equal to two slot units, therefore it would occupy 2 slot spaces in the PLUGSYS case. The maximum number of PLUGSYS modules — such as a Transdcuer Amplifier Module, ECG Amplifier Module, Transit Time Flowmeter Module etc.— which can be plugged into a unit system case depends on the number of slot units required by each module.

SPECIFICATIONS

Specifications	73-1521	73-3103
Accessories	Line Cable, Screw driver for fitting Function Modules, Document Folder for Operating Instructions of Function Modules, 3 x BNC-BNC Output lines	
Dimensions (H x W x D) English	5.9 x 9.25 x 16.5 in	
Dimensions (H x W x D) Metric	150 x 235 x 420 mm	
Housing Construction	Metallic housing, gray plastic coated with pivoting feet	
Module Positions	10 slot units max.	
Power Supply	85 to 264 VAC (40 Watts), output voltage +5 VDC (5 A) and	
Socket Combination	3-pin IEC mains with fuse and mains switch on back of housing	
Weight (English)	10.6 lbs without PLUGSYS modules	
Weight (Metric)	4.8 kg without PLUGSYS modules	

PLUGSYS Minicase Type 609

The MiniCase housing is a low-cost and space-saving housing for 1 or 2 modules that allows PLUGSYS modules to be used as conventional stand-alone units.

Item No.	Description
73-1523	PLUGSYS Minicase, Type 609
73-1541	Four BNC Sockets on Rear for Signal Inputs or Outputs, for PLUSYS Minicase, Type 609

DETAILS

The MiniCase housing is a low-cost and space-saving alternative for 1 or 2 modules that allows PLUGSYS modules to be used as conventional stand-alone units. Unlike the PLUGSYS housings Type 601 and 603, which are supplied complete and ready to use, the MiniCase has no system bus for power supply or signal link between the individual modules. For this reason, the MiniCase systems are supplied custom wired and configured to suit your requirements. The MiniCase is only suitable for use with certain modules or module combinations.

SPECIFICATIONS

Specifications	73-1523
Accessories	Mains Supply Cable and Operating Instructions, 2 x BNC-BNC Output lines (3 if with case extension Option 01)
Dimensions (H x W x D) English	6.3 x 6.3 x 9.8 in; Option 01 = 8.1 in
Dimensions (H x W x D) Metric	160 x 160 x 250 mm; Option 01 = 206 mm
Housing Construction	ABS plastic, flame-resistant to UL94VO, color RAL7032 (stone gray), with ventilation slots at sides
Module Positions	4 slot units max. without extension case; possible to fit 6 slot units using internal straps, Option 1 case extension
Power Supply	85 to 264 VAC (40 Watts), output voltage +5 VDC (5 A) and
Socket Combination	3-pin IEC mains with fuse and mains switch on back of housing
Weight (English)	3.1 lbs approx. without PLUGSYS modules
Weight (Metric)	1.4 kg approx. without PLUGSYS modules

Fiber Optic Micro-Catheter Pressure Transducers (FISO-LS Series)

Fiber optic blood pressure measurement system for measuring blood pressure in very small vessels, isolated hearts, etc. Pressure measurement occurs at the exact location of interest.

FISO–LS series pressure sensors were designed as semi-disposable for multi-use applications in the life-sciences and small animal research. Unlike its disposable counterpart in clinical applications, this sensor is more robust with a protected tip.

The FISO Series and are required for the use of any of the FISO–LS series fiber optic sensors.

are also available.

Item No.	Description
75-0700	FISO Evolution Series EVO-2 Chassis, 24 VDC, 70 W, for Mounting up to 2 FISO Signal Conditioners
75-0704	FISO FPI-LS Signal Conditioner, Single Channel, 15 kHz Analog Output
75-0706	FISO-LS Fiber Optic Pressure Catheter - Standard, 0.9 F, 1.2 M Length, +/- 300 mmHg
75-0707	FISO-LS Fiber Optic Pressure Catheter - Standard, 2 F, 1.7 M Length, +/- 300 mmHg
75-0715	FISO-LS Fiber Optic Pressure Catheter- MRI, 0.9 F, 10 M Length, +/- 300 mmHg
75-0716	FISO-LS Fiber Optic Pressure Catheter- MRI, 2 F, 10 M Length, +/- 300 mmHg
75-0714	FISO-LS Fiber Optic Pressure Catheter - Standard, 2 F, 1.7 M Length, 0 to 10 Bar
75-0713	FISO-LS Catheter Extension Cable and Remote Connect Adapter, 3 meters

DETAILS

FISO-LS series catheters were designed as semi-disposable for multi-use applications in the life sciences and small animal research. This is a robust sensor with a protected tip. The standard transducers have 1 meter of nylon sheathing to protect the fiber, where the 10 m transducers have 9.3 to 9.8 m of nylon sheath, further protecting the glass fiber. With proper use and care these sensors can be used many times.

All sensors are pre–calibrated at the factory and the transducer's calibration information is stored in a smart chip directly on the optical connector. The information is automatically read into the Evolution Software and downloaded to the FPI signal conditioner. No further recalibration is needed — simply zero the transducer.

- Low noise
- Accurate
- Sensor located at tip of fiber
- Easy to use
- Pre-calibrated sensors

The FISO Series **Signal Conditioners** and **EVO Chassis** are required for the use of any of the FISO–LS series fiber optic sensors.

Applications

- Neuroscience—intracranial pressure; blast wave and impact trauma
- Cardiovascular—left ventricular pressure; arterial or venous blood pressure
- Ocular Tonometry—non-invasive intracoular pressure tonometry
- Urology—bladder/ureter pressure
- Spine—intradiscal pressure
- Bone—intramedullary pressure
- MRI Gating—use the 10 m MRI sensor to measure pressure for gating

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FISO Pressure Sensors

The FISO catheters utilize a Fabry-Pérot etalon which is comprised of two parallel reflecting mirrors on either side of a transparent medium, where the distance between the mirrors is known as the etalon cavity length. The transmission characteristic for the F-P etalon has distinct transmission peaks in wavelength as a function of the cavity length, physically corresponding to resonances of the etalon.

FISO's pressure sensors are a flexible embodiment of the F-Petalon. A deformed membrane is assembled over a vacuumed cavity, thus forming a small drum-like structure. The sensing F-Pcavity is located between the base of the drum and the flexible membrane. When pressure is applied, the membrane is deflected toward the bottom of the drum, thus reducing cavity length. After appropriate sensor calibration, completed at the factory, each etalon cavity length corresponds to a specific pressure value. The signal conditioner is designed to determine the cavity length to the nanometer level, providing the researcher with an extremely accurate and repeatable pressure measurement system.

Modular Evolution Chassis

The EVO Chassis provides the power to the signal conditioner modules as well as the digital interface for data transfer between the signal conditioners and the Evolution Software. The EVO Chassis (2- and 5-channel version) includes the Power/Interface module, Evolution data acquisition and instrument control software, USB cable, power supply, and module removal tool. The Power Supply/Interface module has a USB2.0 output and includes the Evolution software. The 2–Channel chassis can house up to 2 FPI signal conditioning modules, while the 5–channel can house up to 5. Chassis do not need to be filled to capacity for use. Add more signal conditioners at any time up to the capacity of the chassis.

The data sampling rate of up to 15 kHz offers the ability to accurately detect fast–changing pressure signals, such as that from mouse heart. Visualize the dichrotic notch with ease! Data is either transferred into the computer via USB to the Evolution acquisition software (at up to 5 kHz) or via the analog output (up to 15 kHz) to an independent data acquisition system.

FISO Signal Conditioners

RS–232/RS–485 Digital Output onboard as well as a 0 to 5 V analog output. An analog output cable is supplied with a BNC connector to interface with common data acquistion systems. The FPI–HR series conditioners are compatible with the fiber optic temperature catheters. The FPI–LS series conditioners are compatible with the FISO–LS pressure catheters. The technique used internally to transmit and receive the light signal allows for continuous sensing that does not rely on light pulses. Since no light is pulsed there is no need for a minimum catheter length as with previous fiber optic sensors. A built–in fan keeps the signal conditioners from overheating or burning out the unit — no special foot stand required.

Catheter Extension Cable

Allows for the remote connection of the sensor 3 meters from the EVO Chassis/Signal Conditioner.

SPECIFICATIONS

Specifications	75-0706	75-0707	75-0715	75-0716	75-0714
Accuracy	2 mmHg or better	2 mmHg	2 mmHg or better	2 mmHg	2 mmHg
Calibration	Factory Calibration no on site calibration needed	Factory Calibration no on site calibration needed	Factory Calibration no on site calibration needed	Factory Calibration no on site calibration needed	Factory Calibration no on site calibration needed
Coated Fiber Diameter	300 µm	640 µm	300 µm	640 µm	640 µm
Coating	Polyimide, Nylon	Polyimide, Nylon	Polyimide, Nylon	Polyimide, Nylon	Polyimide, Nylon
Length	1.2 meters	1.7 meters	10 meters	10 meters	1.7 meters
Measurement media	Fluid or gas	Fluid or gas	Fluid or gas	Fluid or gas	Fluid or gas
Pressure Range	±300 mmHg	±300 mmHg	±300 mmHg	±300 mmHg	0 to 10 bar
Resolution	< 0.1 mmHg	< 0.3 mmHg	< 0.1 mmHg	< 0.3 mmHg	< 0.3 mmHg
Sensitivity Thermal Effect	< 0.04%/°C	< 0.05%/°C	< 0.04%/°C	< 0.05%/°C	< 0.05%/°C
Sensor Diameter	300 µm	640 µm	300 µm	640 µm	640 µm
Standard bare fiber length	20 cm	70 cm	20 cm	70 cm	70 cm

Specifications	75-0706	75-0707	75-0715	75-0716	75-0714
Storage temperature	−40–+80°C (−40–176°F)	−40–+80°C (−40–176°F)	−40–+80°C (−40–176°F)	−40–+80°C (−40–176°F)	−40–+80°C (−40–176°F)
Tolerated bend radius	10 mm (0.4in)	10 mm (0.4in)	10 mm (0.4in)	10 mm (0.4in)	10 mm (0.4in)
Uncoated Fiber Diameter	260 μm	550 μm	260 μm	550 μm	550 μm
Zero Thermal Effect	0.2 mmHg*°C	0.4 mmHg*°C	0.2 mmHg*°C	0.4 mmHg*°C	0.4 mmHg*°C

Ponemah CARDIO Software

For over 3 decades Ponemah Software has been trusted by researchers worldwide to discover new insights into their research applications. Ponemah is the data acquisition platform that powers our DSI Implantable Telemetry solutions for cardiovascular research. Ponemah CARDIO software is tailored to acquire, visualize, and report cardiovascular endpoints. A wide range of essential cardiovascular metrics can be derived in real time from the primary signals acquired from in vivo models or ex vivo heart perfusion setups.

- Data acquisition, visualization, and analysis of in vivo or ex vivo cardiovascular hemodynamic and electrophysiologic signals.
- Accurate and consistent results through industry validated algorithms.
- Adjust algorithm settings to optimize signal analysis from various species and unique morphologies.
- Acquisition of primary signals from our DSI* ACQ-7700 signal conditioners or HSE* PLUGSYS Modules as well as third-party analog signals.
- Built-in visualization tools to explore data and gain complete confidence in your results
- Fast-tracks subsequent experiments by saving settings as a reusable Protocol
- Immediate results with real-time data visualization and analysis with visual validation marks.
- Refine results by re-analyzing data segments post-hoc and/or changing mark placement.

*Data Sciences International, Hugo Sachs Elektronik and Harvard Apparatus are all divisions of Harvard Bioscience, Inc.

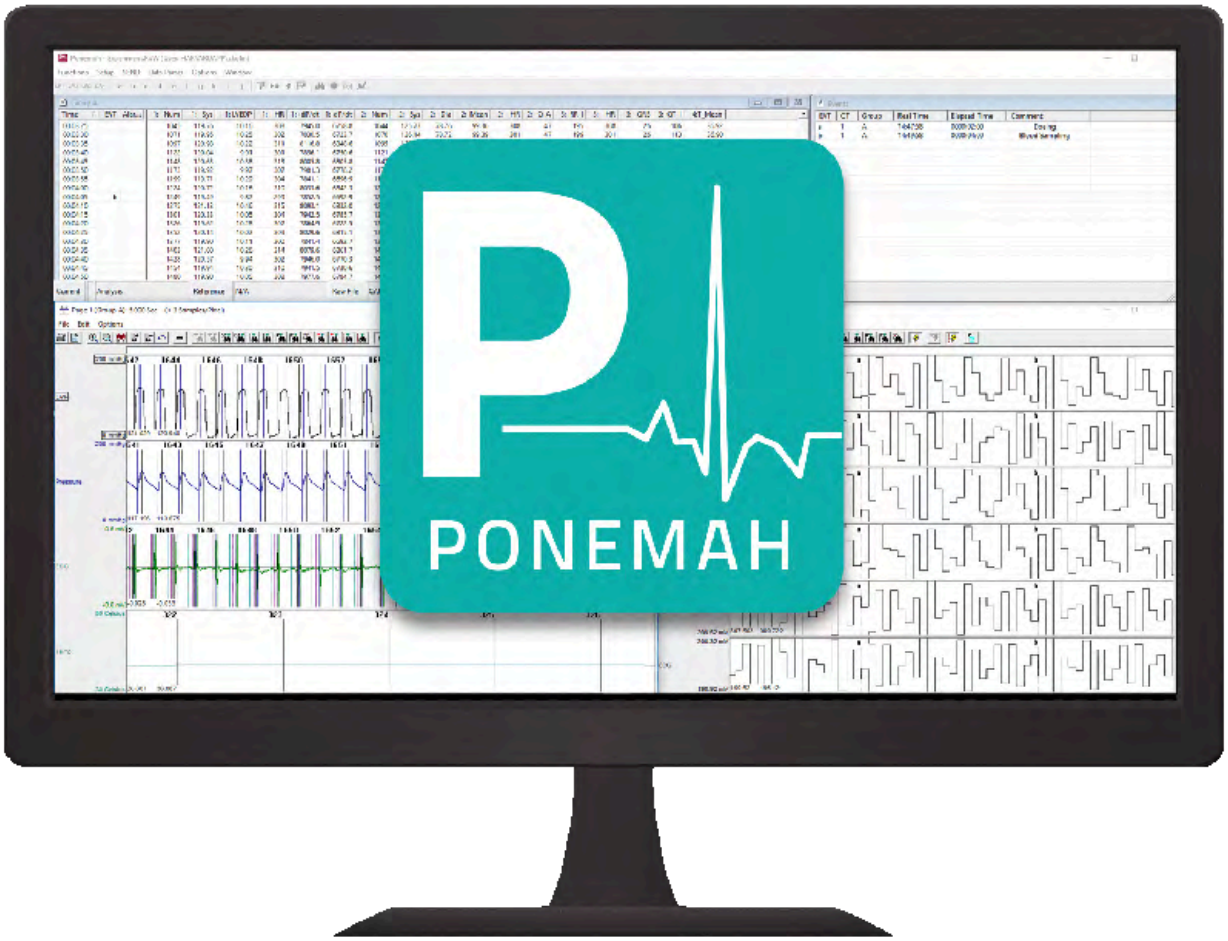
Additional Resources:

- Complete line of
- HSE/HA
- Isolated or Perfusion Systems
- HSE Cases and Modules
- HSE

- DSI ACQ-7700 Cases and Signal Conditioners
- Other Ponemah Platforms including CARDIO, PULMODYN, and BDAS

Also see our

Item No.	Description
73-5206	Ponemah CARDIO, Comprehensive Cardiovascular Data Acquisition and Analysis Software
73-3330	Data Acquisition Hardware, USB Universal Stand Alone Version
73-4818	USB-C Data Acquisition Module for PLUGSYS, 16 Channels
73-4817	USB-C Data Acquisition Module for PLUGSYS, 8 Channels



DETAILS

Data Analysis Modules Included with Ponemah CARDIO*

Each data analysis module derives a wide range of scientifically validated, industry approved cardiovascular endpoints.

- Multi-Lead Electrocardiogram (ECG)
- Blood Pressure (BP)
- Left Ventricular Pressure (LVP)
- Cardiac Volume (CVOL)
- Action Potential (MAP)
- Systemic Blood Flow (SBF)
- Coronary Blood Flow (CBF)

*Expand the specifications section below for a complete list of parameters derived from the primary signals

Reliable Data Services: We also offer Data Analysis as a service. We can assist with the creation of high quality, usable reports that summarize your experimental data and provide you with more time to evaluate the experimental results and plan your future studies. Contact us for more information.

- DSI Scientific Services for assistance in study setup and data analysis.
- Customized report packages for summarizing experimental data.
- Saves time, enhances confidence in results, and facilitates planning for future experiments.

SPECIFICATIONS

Multi-Lead Electrocardiogram (ECG)

Analyzes ECG signals to provide single and multi-lead calculations. The ECG signal can have positive, negative, or bi-phasic T waves, P waves, and QRS complexes and validation marks, such as for Q, R, S, End of T and Beginning of P are automatically drawn.

Multi-Lead ECG parameters can also be calculated to provide additional information related to QT interval prolongation and dispersion.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	**Definition**
Num	The number of the cardiac cycle.
HR	The heart rate is computed in beats-per-minute.
R-H, P-H, T-H	Height of the waves from the Iso-electric level, in millivolts.
T-HN	Lowest point between the end of the S wave and the end of the T.
ST-I	Time interval in milliseconds from the S wave to end of the following T wave.
ST-E	The ST elevation, measured in “ST Measure” milliseconds after the S wave, from the Iso-electric level.
QRS	Time interval of the QRS complex.
PR-I, QT-I, RR-I	Common Interval measurements.
QAT	Q Alpha T is the time interval from the Q wave to the peak of the following T wave.
QTcb, QTcf, QTcv, QTcm and QTck	Multiple corrected QT intervals (Bazett, Fridericia, Van de Water, Matsunaga and King).
EQTS, EQTSc, EQTM, EQTMcs, EQTMce, QTMc	Various cross channel calculations available with Multilead ECG Analysis.
QTD	QT Dispersion available with Multilead ECG Analysis.

QR-I, QRSA	QR interval, QR amplitude.
MxdV	Maximum derivative of the R wave.
T-A	Area of the T wave from the Iso-electric level.
PCt, TCt	The number of valid waves encountered in the logging period.
QTCt	QT count.
Count	Reports the number of ECG cycles in a given logging (averaging) period.
BAD	The number of arrhythmic beats detected during a specified logging period.
GW, TW	The Good Wave counts and number (Total Wave) of good and bad complexes.
QATN	Time, in milliseconds, between the Q wave and the lowest point between the end of S and the end of T wave.
PWdth	P Width reports the time, in milliseconds, between the start and end of the P wave.
Tpe-I	The time in milliseconds between the peak of the T wave and the end of the T wave.
T-P	The signal value at the peak of the T wave relative to the Iso-electric level.
Noise	This parameter reports an approximation of the noise level in the ECG cycle.

Blood Pressure (BP) Analysis

Analyzes arterial and venous pressures. Pulse Wave Velocity calculations are also available when combined with a DSI or HSE hardwired solution using two pressure catheters.

In addition to displaying aortic pressure recordings, validation marks are automatically set for Diastolic, End Diastolic, Systolic. In addition, users can define and display % Recovery Point.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	**Definition**
Num	The number of the cardiac cycle.
Sys, Dia, Mean	Systolic, Diastolic, and Mean pressure.
PH, HR, TTPK, ET	Common parameters include Pulse height, Heart rate, Time to peak, Ejection time.

+dP/dt, -dP/dt	Maximum positive and negative value of the first derivative of the pressure.
%REC	The amount of time it takes the pressure to recover.
NPMN	Non-pulsatile mean pressure.
Q-A	The Q-A Interval is the time in milliseconds from the start of the Q-wave, in the ECG trigger channel, to the start of the systolic pressure rise.
Mean2	An alternate representation for Mean calculated as (Systolic + 2 * Diastolic)/3.
PTT	Pulse Transit Time (PTT) is the time between the prior systolic time of the upstream channel and the systolic time of the selected channel. This time is reported in ms.
PWV	Pulse Wave Velocity (PWV) is the velocity calculated by using the Pulse Wave Distance (PWD) and Pulse Transit Time (PTT). PWV is calculated as: Pulse Wave Velocity = Pulse Wave Distance / Pulse Transit Time.
IBIs, IBIms, IBIed	Inter-Beat Interval (IBI) is the time in milliseconds between cardiac cycles and allows Heart Rate Variable (HRV) to be calculated from Blood Pressure signals (Frequency Domain).
Count	Reports the number of cycles in a given logging period.

Left Ventricular Pressure (LVP) Analysis

Analyzes pressure signals from the left ventricle and is used as a reference signal for other analysis modules, such as Cardiac Volume. Parameters such as Left Ventricular End Diastolic Pressure, Systolic Pressure, Percent Recovery Times and -dP/dt max can be marked automatically.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	**Definition**
Num	The number of the cardiac cycle.

Sys	The systolic pressure is the maximum pressure that occurs during the cardiac cycle.
LVEDP	The left ventricular end diastolic pressure is the pressure at the last zero crossing of the differentiated pressure during the rise to the systolic period.
EMw	Electromechanical Window represents the time difference in ms between the end of electrical systole (end of the T wave) and the end of ventricular relaxation. It is a potential biomarker for Torsades de Pointes (TdP) risk that has greater predictability than using QT prolongation.
Min	The minimum pressure during the cardiac cycle.
TTI	Tension-Time Index is the area under the left ventricular pressure during the ejection phase of the contraction. This is the integration between the LVEDP point and -dP/dtMAX.
DP	Developed pressure is the difference between the systolic pressure and the left ventricular end diastolic pressure (SYS-LVEDP).
HR	The heart rate is computed in beats-per-minute. It is calculated by taking the reciprocal of the time interval for the cardiac cycle multiplied by 60.
+dP/dt	+dP/dt is the maximum positive value of the first derivative of the pressure that occurs during the cardiac cycle.
-dP/dt	-dP/dt is the maximum negative value of the first derivative of the pressure that occurs during the cardiac cycle.
CI	Contractility index is +dP/dt divided by the pressure at that point.
RT1, RT2	The Relaxation Time is the period from -dP/dt to the time specified by the Relaxation Time attribute. The time is reported in milliseconds.
dP (A, B, C, and D)	These parameters report the value of dP/dt at the pressure levels specified in dP/dt A, dP/dt B, dP/dt C, and dP/dt D (in the attributes window).
NPMN	The non-pulsatile mean pressure reported for a logging period. This parameter is still reported even if no pulse pressure exists.
Q-A	The Q-A Interval is the time in milliseconds from the start of the Q-wave, in the ECG trigger channel, to the start of the systolic pressure rise (LVEDP).
IVT	The time in milliseconds from the start of the systolic pressure rise (LVEDP) to the maximum slope of the systolic pressure rise (+dP/dt).
TTI-T	LVEDP to -dP/dt. The time is in milliseconds.
Tau	Tau is the time constant isovolumic left ventricular pressure decay. It is reported in milliseconds, and can be defined using Pressure, Developed Pressure and dP/dt.
Period	The duration of the current cycle time, in milliseconds.
Count	Reports the number of cycles in a given logging period.

Cardiac Volume (CVOL) Analysis

Can analyze any volume from the circulatory system, as measured by a pressure volume catheter, and can derive on a beat-to-beat basis values for the cardiac cycle. Validation marks provide the user with visual documentation that the real-time analysis is providing appropriate cycle recognition.

Additional features built into the Data Review functionality allow the Cardiac Volume channel and LVP channel to be analyzed in a post process mode by the Pressure-Volume Loop analysis. Pressure-Volume Loops permit the display and analysis of left ventricular pressure cycles plotted against cardiac volume cycles.

Pressure-Volume Loop analysis features and calculations:

- Cuvette Calibration - Catheter Selection - Choose from 40 pre-defined PV catheters for volume calibration during acquisition.
- Parallel Volume calculation - Volume component due to parallel conductance. Parallel volume is subtracted from summed volume signal by means of a saline bolus injection or input of empirical data.
- Alpha Correction Factor - Reconcile the volume obtained using conductance technology with the volume obtained by other means. Stroke Volume is divided by Alpha.
- ESPVR (End Systolic PV Relationship) - Slope, X intercept, correlation coefficient.
- EDPVR (End Diastolic PV Relationship) - α, β, X intercept, correlation coefficient.
- PRSW (Pre Recruitable Stroke Work) - Slope, X intercept, correlation coefficient.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	Definition
Num	The number of the cardiac cycle.
Vmin	The minimum volume value in a cycle.
Vmax	The maximum volume value in a cycle.
SV	The stroke volume, which equals Vmax - Vmin.
-dPV	The volume at the LVP Min Slope mark.
Ped	The pressure at the LVEDP mark.
Ved	The volume at the LVEDP mark.
%EF	Ejection fraction, calculated as Stroke Volume/Vmax * 100.

PFR	Peak filling rate.
-dV	Peak emptying rate.
TPFR	Time to peak filling rate.
DFT	Diastolic Filling Time.
%FT	Time to peak filling as a percentage of Diastolic fill time, equals TPFR/DFT * 100.
Pes	Pressure at max elastance.
Ves	Volume at max elastance.
SW	Stroke Work.
Ea	Arterial elastance.
HR	Heart rate. Computed in beats-per-minute.
CO	Cardiac Output.

Action Potential (MAP) Analysis

Analyzes a host of action potentials with focus on key regions such as plateau, recovery time and upstroke velocity.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	**Definition**
Num	The number of the cardiac cycle.
Max	The Maximum Voltage that occurred during a cardiac cycle.
EDV	The voltage prior to the upstroke of the action potential.
Min	The minimum voltage that occurred during a cardiac cycle.
Plto	The plateau voltage.
Amp	PLTO minus EDV.
Rate	The beats-per-minute.
+dV	The maximum positive rate of change that occurred.
-dV	The maximum negative rate of change that occurred.
REC1	The time, in milliseconds, from the beginning of the upstroke of the action potential, to the point where the signal drops below the level corresponding to the % Recovery 1 level.
xR1	The number of cycles that did not reach the % Recovery 1 level, within the logging period.

REC2	The time, in milliseconds, from the beginning of the upstroke of the action potential, to the point where the signal drops below the level corresponding to the % Recovery 2 level.
xR2	The number of cycles that did not reach the % Recovery 2 level, within the logging period.
REC3	The time, in milliseconds, from the beginning of the upstroke of the action potential, to the point where the signal drops below the level corresponding to the % Recovery 3 level.
xR3	The number of cycles that did not reach the % Recovery 3 level, within the logging period.
%Max	The time, in milliseconds, from the beginning of the upstroke of the action potential, to the point where the signal recovers to 100% or as close to 100% as possible.
Time	The time interval between action potentials.
Cnt	The number of cycles in the logging period.
RiseT	The time, in milliseconds, between the EDV and Max points.

Systemic Blood Flow (SBF) Analysis

Analyzes systemic blood flow from the circulatory system and eliminates drift resulting from certain types of flow meters.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	**Definition**
Num	The number of the cardiac cycle.
Mean	The integrated level of the flow for the cardiac cycle.
FMax	Maximum Flow that occurred for a cardiac cycle.
FMin	Minimum Flow that occurred for a cardiac cycle.
CO	Cardiac Output is the mean flow normalized to ml/Min. Note: When running in a logging mode other than 1 epoch, the CO value will be calculated from the averaged mean flow value.
SV	Stroke Volume.
+dQ	+dQ is the maximum positive value of the first derivative of the flow that occurs during the cardiac cycle.
Iso	The value of flow during the rapid up rise of the flow signal.

TPR	Total Peripheral Resistance.
NPMN	The non-pulsatile mean calculated over the complete logging interval.

Coronary Blood Flow (CBF) Analysis

Provides coronary flow and volume information during systolic and diastolic periods in conjunction with the LVP module.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	**Definition**
Num	The number of the cardiac cycle.
Mean	The integrated level of the flow for the cardiac cycle.
FMax	Maximum Flow that occurred for a cardiac cycle.
FMin	Minimum Flow that occurred for a cardiac cycle.
CO	Cardiac Output.
SV	Stroke Volume.
+dQ	+dQ is the maximum positive value of the first derivative of the flow that occurs during the cardiac cycle.
SFlw	Flow during systolic part of cardiac cycle.
DFlw	Flow during diastolic part of cardiac cycle.
SVol	Volume during the systolic part of the cardiac cycle.
DVol	Volume during the diastolic part of the cardiac cycle.
-Flow	Any negative flow that occurred during the cardiac cycle.
TVol	Total Volume is the sum of Systolic Volume and Diastolic Volume: SVol + DVol.
NPMN	The non-pulsatile mean calculated over the complete logging interval.

PULMODYN Data Acquisition Software for Respiratory Experiments

Ponemah PULMODYN Software: Ponemah Software has been trusted by researchers worldwide for over 3 decades to discover new insights into their research applications. Ponemah PULMODYN software is tailored to acquire, visualize, and report physiologic endpoints. A wide range of essential respiratory and hemodynamic metrics can be derived in real time from the primary signals acquired from in vivo models or ex vivo lung perfusion setups.

- Data acquisition, visualization, and analysis of in vivo or ex vivo respiratory and hemodynamic signals.
- Accurate and consistent results through industry validated algorithms.
- Adjust algorithm settings to optimize signal analysis from various species and unique morphologies.
- Acquisition of primary signals from our DSI* ACQ-7700 signal conditioners or HSE* PLUGSYS Modules as well as third-party analog signals.
- Built-in visualization tools to explore data and gain complete confidence in your results.
- Fast-tracks subsequent experiments by saving settings as a reusable Protocol.
- Immediate results with real-time data visualization and analysis with visual validation marks.
- Refine results by re-analyzing data segments post-hoc and/or changing mark placement.

*Data Sciences International (DSI), Hugo Sachs Elektronik (HSE) and Harvard Apparatus are all divisions of Harvard Bioscience, Inc. (HBIO)

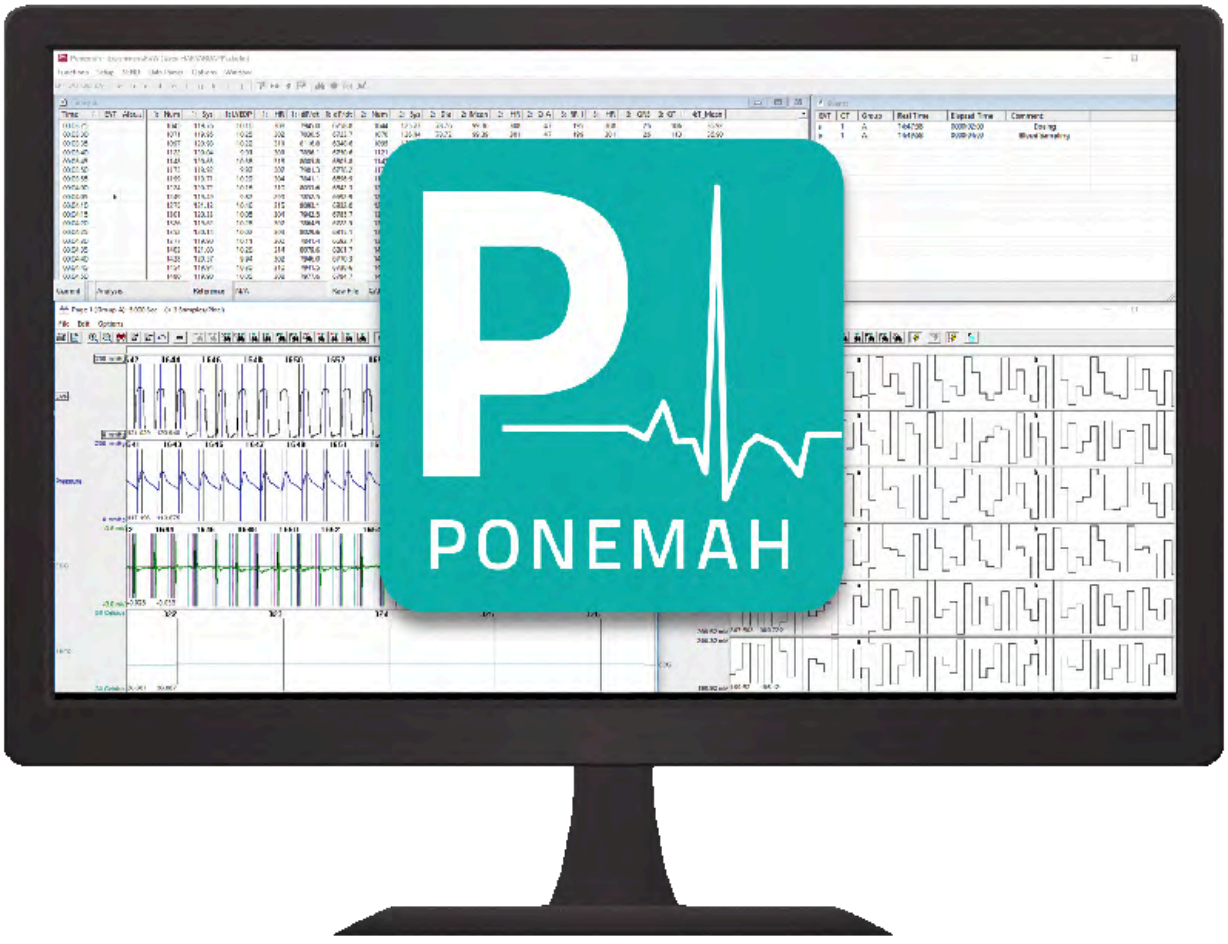
Additional Resources:

- Complete line of HSE/HA
- for Tracheal Ring Studies
- HSE PLUGSYS and
- HSE
- DSI ACQ-7700 Cases and Signal Conditioners

- Other Ponemah Platforms including CARDIO, TISSUEPRO and BDAS

Also see our

Item No.	Description
73-5207	Ponemah PULMODYN, Comprehensive Respiratory Data Acquisition and Analysis Software
73-3330	Data Acquisition Hardware, USB Universal Stand Alone Version
73-4818	USB-C Data Acquisition Module for PLUGSYS, 16 Channels
73-4817	USB-C Data Acquisition Module for PLUGSYS, 8 Channels



DETAILS

Ponemah PULMODYN is a comprehensive data acquisition and analysis platform for all your respiratory study needs. Primary respiratory airflow and airway, thoracic or esophageal pressure and hemodynamic signals are acquired using one of several available data acquisition hardware setups. PULMODYN derives secondary signals (e.g. tidal volume) in real time from the primary signals. Data visualization, analysis and reporting features, saved acquisition and analysis protocols allow you to rapidly go from data collection to visualization and analysis.

Data Analysis Modules Included with Ponemah PULMODYN*

Each data analysis module derives a wide range of scientifically validated, industry approved pulmonary endpoints.

- Pulmonary Compliance & Resistance (PCR/PCRP)
  - Pulmonary Air Flow and Airway Resistance (PAF) Included with PCR
- Systemic Blood Flow (SBF)
- Blood Pressure (BP)

*Expand the specifications section below for a complete list of parameters derived from the primary signals

Reliable Data Services: We also offer Data Analysis as a service. We can assist with the creation of high quality, usable reports that summarize your experimental data and freeing up your time to evaluate the experimental results and plan your future studies.

- DSI Scientific Services for assistance in study setup and data analysis.
- Customized report packages for summarizing experimental data.
- Saves time, enhances confidence in results, and facilitates planning for future experiments.

SPECIFICATIONS

Pulmonary Air Flow and Airway Resistance (PAF)

Analyzes any derived pulmonary signal derived and draws automated validation marks for Start of Inspiration, Start of Expiration and Start of Apnea and other parameters.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	Definition
Num	The number of the respiratory cycle.

Name	Definition
PIF	Peak Inspiratory Flow is the maximum inspiratory flow that occurs during a valid breath.
PEF	Peak Expiratory Flow is the maximum expiratory flow that occurs during a valid breath.
TV	The Tidal Volume is the total volume of air that was inspired during a breath and is always reported in millimeters.
MV	The Minute Volume is the product of the tidal volume and the number of breaths-per-minute.
BPM	The number of breaths-per-minute is calculated on a breath-to-breath basis.
IT	The Inspiratory Time is calculated from the first zero crossing of the flow in the inspiratory direction to the zero crossing of the flow in the expiratory direction. The time is in milliseconds.
ET	The Expiratory Time is calculated from the zero crossing of the flow in the expiratory direction until flow reaches zero again. The time is in milliseconds.
TT	The Total Time is the time period, in milliseconds, from one valid breath to the next valid breath.
AT	The Apnea Time.
CaRaw (only AWR)	Specific Airway Resistance . This parameter is the product of Alveolar Compliance and Airway Resistance
Phase	Phase shift between mouth and chest volume, in degrees. For JET RIP, this represents the phase difference between the chest and abdomen.
dT(only AWR)	The delay , in milliseconds, between the mouth and chest volumes.
PEnh	Enhanced Pause.
RT	Relaxation Time. This is the time from the start of expiration to the point where the volume signal drops by the Percent Relaxation value from its maximum value for the cycle.
TVe	This is the difference between the volume at the start expiration mark and the volume at the point prior to the next cycles start inspiration mark. It is always reported in milliliters.
IF50	IF50 reports the inspiratory flow value at the point where the volume signal rises to 50% of the tidal volume.
EF50	EF50 reports the expiratory flow value at the point where the volume signal drops to 50% of the tidal volume.
AVol	Accumulated Volume is the summed total of the Tidal Volume (TV) from a reset point forward and is reported in milliliters.

Pulmonary Compliance & Resistance (PCR/PCRP)

Analyzes pulmonary signals from a pneumotachometer, along with a pressure, in isolated organ models or in vivo anesthetized animals. Values for these derived signals are calculated on a breath-to-breath basis for each respiratory cycle.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	Definition
Num	The number of the respiratory cycle.
PIF, PEF	Peak Inspiratory Flow, Peak Expiratory Flow.
TV, MV	Tidal Volume, Minute Volume
BPM	The number of breaths-per-minute is calculated on a breath-to-breath basis.
IT, ET, TT, AT	Inspiratory Time, Expiratory Time, Total Time, Apnea Time.
Cdyn, Res, Cond	Compliance, Resistance, Conductance.
ResI1, ResI2, ResE1, ResE2	Resistance calculated at various points of inspiration and expiration.
CAvg, RAvg	Compliance and Resistance value averaged.
PInspS(P1), PExpS(P2), Piso1(P3), Piso2(P4)	Pressure value at different time points of flow signal.
Fiso1(F1), Fiso2(F2)	Flow on clearing isovolumic levels during inspiration and expiration.
PEnh	Enhanced Pause. Calculated as: ((ET+AT)/RT-1)*(PEF/PIF). Formula from Noninvasive Measurement of Airway Responsiveness in Allergic Mice Using Barometric Plethysomgraphy Hamelmann et al.
RT	Relaxation Time.
WOBi, WOBe, WOB	Work of Breathing Inspiration, Work of Breathing Expiration and Work of Breathing (sum)
POBi, POBe, POB	Power of Breathing Inspiration, Power of Breathing Expiration and Power of Breathing (rate at which work was performed over inspiration and expiration).
TVe	The difference between the volume at the start of expiration mark and the volume at the point prior to the next cycles start inspiration mark.
AVol	Accumulated volume.

Name	Definition
IF50	Inspiratory flow value at the point where the volume signal rises to 50% of the tidal volume.
EF50	Expiratory flow value at the point where the volume signal drops to 50% of the tidal volume.

Systemic Blood Flow (SBF) Analysis

Analyzes systemic blood flow from the circulatory system and eliminates drift resulting from certain types of flow meters.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	Definition
Num	The number of the cardiac cycle.
Mean	The integrated level of the flow for the cardiac cycle.
FMax	Maximum Flow that occurred for a cardiac cycle.
FMin	Minimum Flow that occurred for a cardiac cycle.
CO	Cardiac Output is the mean flow normalized to ml/Min. Note: When running in a logging mode other than 1 epoch, the CO value will be calculated from the averaged mean flow value.
SV	Stroke Volume.
+dQ	+dQ is the maximum positive value of the first derivative of the flow that occurs during the cardiac cycle.
Iso	The value of flow during the rapid up rise of the flow signal.
TPR	Total Peripheral Resistance.
NPMN	The non-pulsatile mean calculated over the complete logging interval.

Blood Pressure (BP) Analysis

Analyzes arterial and venous pressures. Pulse Wave Velocity calculations are also available when combined with two arterial pressure transducers and compatible amplifiers.

In addition to displaying aortic pressure recordings, validation marks are automatically set for Diastolic, End Diastolic, Systolic. In addition, users can define and display % Recovery Point.

The list below describes the parameters calculated either in real-time or during subsequent analysis.

Name	Definition
Num	The number of the cardiac cycle.
Sys, Dia, Mean	Systolic, Diastolic, and Mean pressure.
PH, HR, TTPK, ET	Common parameters include Pulse height, Heart rate, Time to peak, Ejection time.
+dP/dt, -dP/dt	Maximum positive and negative value of the first derivative of the pressure.
%REC	The amount of time it takes the pressure to recover.
NPMN	Non-pulsatile mean pressure.
Q-A	The Q-A Interval is the time in milliseconds from the start of the Q-wave, in the ECG trigger channel, to the start of the systolic pressure rise.
Mean2	An alternate representation for Mean calculated as (Systolic + 2 * Diastolic)/3.
PTT	Pulse Transit Time (PTT) is the time between the prior systolic time of the upstream channel and the systolic time of the selected channel. This time is reported in ms.
PWV	Pulse Wave Velocity (PWV) is the velocity calculated by using the Pulse Wave Distance (PWD) and Pulse Transit Time (PTT). PWV is calculated as: Pulse Wave Velocity = Pulse Wave Distance / Pulse Transit Time.
IBIs, IBIms, IBIed	Inter-Beat Interval (IBI) is the time in milliseconds between cardiac cycles and allows Heart Rate Variable (HRV) to be calculated from Blood Pressure signals (Frequency Domain).
Count	Reports the number of cycles in a given logging period.

Transducer Amplifier (ISO510A)

Designed to work with a wide range of transducers for evaluating pressure, strength or respiration in various research areas for experiments involving isolated organs and tissues.

The ISO510A amplifier module must be purchased with the 76-0586 power supply box.

Item No.	Description
76-0627	ISO510A Amplifier Module without Power Supply Box
76-0586	Power Supply Box for up to four ISO510A Amplifiers (BR4740A)

DETAILS

The Panlab Coupler Module ISO510A is an Amplifier for bridge-system designed to work with a wide range of different transducers for evaluating pressure, strength or respiration in various research areas. As an example, the ISO510 model is currently associated with the isometric or isotonic transducers for the study of in vitro tissues preparations using Organ Baths.

- High Gain Differential AC/DC Amplifier
- Includes a filter allowing the suppression of background noise
- A Transducer Balance allows a fine adjustment of the signal baseline
- Allows external monitoring of its output signal

The Panlab ISO510A Amplifier can work in both AC and DC and amplifies signal up to 2.000 times. The Amplifier contains a filter allowing the suppression of the noise produced by electrical or mechanical artefacts associated with the experiment running (for instance, ventilation and heating pump systems in Organ Baths) and then eliminates vibrations that may affect the signal received from the biological preparations. A Transducer Balance option allows a fine adjustment of the signal baseline ("zero") when the transducer is not excited by the variable to be measured. The ISO510A amplifier also allows the external monitoring of its output signal, for instance to an oscilloscope.

SPECIFICATIONS

Gain	0-2000
Input Impedence	1.5 kOhms
Output Impedence	<100 Ohms
Feed Power	18 VDC
Output Voltage	10 V
Transducer Power Supply	10 VDC
Band Frequency	0-5 KHz
Filters	>3 Hz or >20 Hz
Filters AC	0.16 Hz
Connector	5-pin Female Audio Connector
Certification	CEE Compliance

Vernier Controls for Transducers

The vernier control allows an exact pre-stretching of the tissue preparation in order to ensure optimum preload tissue tension and, as a result, optimal contractile force of the musculature. The use of an integrated micrometer screw allows also to define exactly the change in length.

Item No.	Description
73-4893	Vernier Control Type 850L, Fine Tuner for Force and Displacement Transducers

DETAILS

The vernier control allows an exact pre-stretching of the tissue preparation in order to ensure optimum preload tissue tension and, as a result, optimal contractile force of the musculature. The use of an integrated micrometer screw allows also to define exactly the change in length.

- Three versions available
- Robust mechanical construction with less friction
- Allows fine adjustment

Small Disposable Electrodes, Gentle or Aggressive Adhesive

For use in EMG, NCS and EP studies; also suitable for use with EKG monitors. Latex-free; meet or exceed AAMI specifications

Item No.	Description
72-7091	Gentle Adhesive Small Disposable Electrode, 2.2cm² (0.88 in²), pkg of 60 (3 electrodes per strip)

DETAILS

These Small Disposable Cloth Electrodes are for use in EMG, NCS and EP studies and are latex-free. They meet or exceed AAMI specifications and are also suitable for use with EKG monitors.

- Small size for easy placement on difficult locations
- Gentle or aggressive adhesive
- Solid gel is repositionable and easy clean-up
- Hypoallergenic for long term use with no irritation
- Cloth base is comfortable and conforming
- Silver/Silver Chloride sensor gives a clear signal
- Multipurpose use for EMG or EKG

The Small Disposable Agressive Adhesive Electrodes are supplied as 3 electrodes per strip in a package of 30 electrodes. This Small Disposable 2.5 cm^2 (1.0 in^2), aggressive adhesive electrode is designed for easy placement and superior adhesion. A specially formulated adhesive solid gel ensures full sensor contact and excellent readings.

The Gentle Adhesive Small Disposable Electrodes are supplied as 3 electrodes per strip in a package of 60 electrodes. They attach with an alligator clip or standard connector lead wire. These Small Disposable 2.2 cm^2 (0.88 in^2) gentle adhesive electrodes are designed with a gentle adhesive for use in sensitive areas.

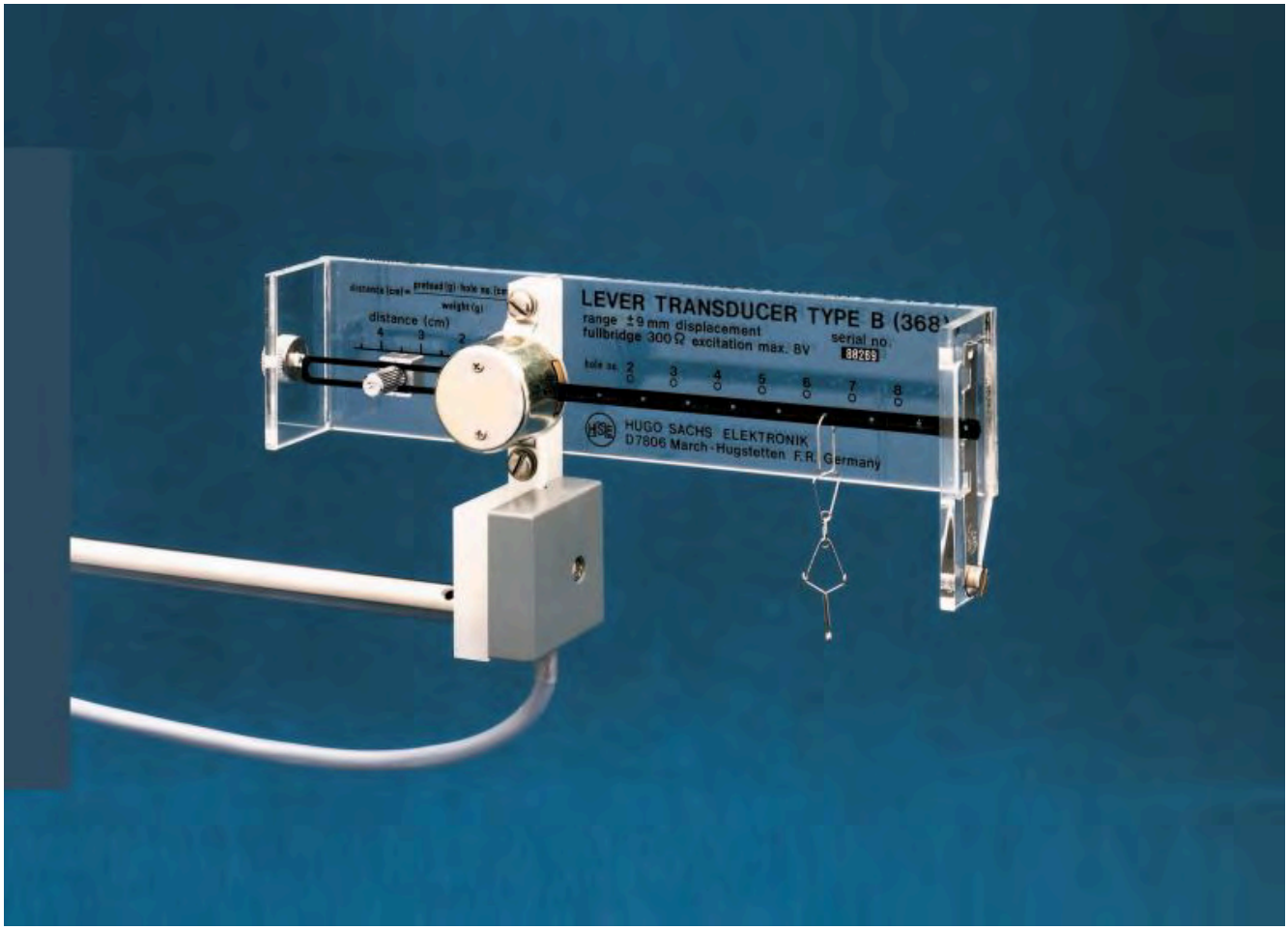
SPECIFICATIONS

Specifications	**72-7090**	**72-7091**
Adhesive Material	Solid Gel	Solid Gel
Diameter (English)	1.0 in^2	0.88 in^2
Diameter (Metric)	2.5 cm^2	2.2 cm^2

Isotonic Lever Transducers

This system is designed to transduce displacements during contractions and movements into proportional electric currents. The amount of force required to operate the system is exceedingly small, providing ideal isotonic measurement conditions for physiological and pharmacological research.

Item No.	Description
73-0857	HSE-HA Isotonic Lever Transducer Model B40 for PLUGSYS System
73-0572	Thread Connection Clip, Clamp for fixing thread



DETAILS

This system is designed to transduce displacements during contractions and movements into proportional electric currents. The amount of force required to operate the system is exceedingly small, providing ideal isotonic measurement conditions for physiological and pharmacological research.

- Very low friction, ideal isotonic measurement conditions
- Easy calibrating conditions
- Large linear measuring range 40 mm
- Ideal for smooth muscle preparations

This arrangement of a lever transducer with any bridge system (DC measuring bridge or TAM plug-in module of our PLUGSYS) is particularly well suited to isotonic measurements in smooth muscle preparations in isolated organ and tissue baths. Values are transmitted as a result of movements of a permanent magnet within field plates. The instrument is calibrated by locking the end of the lever into the calibration stops on the frame. These stops represent full deflections of ±10 and ±20 mm. If the organ preparation is attached to hole no. 10, this is equivalent to a movement of ±20 mm (= 40 mm total), reducing for each lower hole used. The unit can be interfaced with almost any type of AC or DC bridge. There are 3 calibration steps on the frame: ±22 mm, 0 and –22 mm at a distance of 100 mm from the pivot measured at the arch. The calibration amplitude is reduced at the various holes as shown below.

SPECIFICATIONS

Specifications	73-0857	73-2692	73-2693	73-2694
Bridge Resistance	4 x 300?	4 x 300?	4 x 300?	4 x 300?
Certifications	CE	CE	CE	CE
For use with X Amplifier Type	PLUGSYS	Harvard Appartus	Grass	Gould 6600
Frequency Range	0 to 10 Hz	0 to 10 Hz	0 to 10 Hz	0 to 10 Hz
Frictional Torque of Lever	0.1 mN cm	0.1 mN cm	0.1 mN cm	0.1 mN cm
Mounting Rod Length Metric	130	130	130	130
Mounting Rod OD Metric	6	6	6	6
Supply Voltage	5 V DC or AC (max. 8 V)	5 V DC or AC (max. 8 V)	5 V DC or AC (max. 8 V)	5 V DC or AC (max. 8 V)

Specifications	73-0857	73-2692	73-2693	73-2694
Zero Drift	< 0.03% / oC FS	< 0.03% / oC FS	< 0.03% / oC FS	< 0.03% / oC FS

PLUGSYS R-Wave Trigger Module (RWT)

Triggers (starts) a stimulator or any other device with the R-wave of an ECG signal. Requires ECGA module.

Item No.	Description
73-1753	R-Wave Trigger Module (RWT) for ECG Amplifier Module (ECGA)

DETAILS

The **R-Wave Trigger Module** (RWT) is especially designed to trigger (start) a stimulator or any other device with the R-wave of an ECG signal.

The ECG signal is measured with the PLUGSYS . The R-wave trigger module is internally connected to the ECG Amplifier and works only together with this amplifier.

The R-wave trigger module can be used (e.g., for synchronized stimulation of the heart) by triggering a delay module of a stimulator. It is possible to set the stimulation pulses delayed from the R-wave into the vulnerable phase to produce ventricular fibrillations. The trigger output of this module must be connected to the trigger input of a stimulator with a BNC cable.

SPECIFICATIONS

Specifications **73-1753**

Accessories	BNC output cable, operating instructions
Adjustable Blocking Time	Blocking time for trigger signal can be adjusted so that circuit is inactive for fixed time; time can be set with potentiometer 'BLOCKING TIME' in range from 50 msec to 500 msec; LED indicates blocking time
Dimensions (H x W x D)	5.1 x 0.8 x 3.9 in (128.7 x 20.2 x 100 mm)
Output	BNC connector TRIGGER OUT at front panel open collector TTL signal, pull-up resistor 2.2 k; jumper on board defines whether positive or negative pulses used as trigger pulses
PLUGSYS Width*	1 slot unit
Power Supply	Through ECG Amplifier Type 689
R-Wave Indication	LED and beep to indicate R-wave; loudness of beep can be set with potentiometer
Threshold	Threshold for triggering can be set with potentiometer
Weight	0.4 lb (0.2 kg)
Accessories	BNC output cable, operating instructions

Universal Isolated Stimulator Output (UISO)

Required to produce ungrounded (isolated or floating) stimuli and prevent interference in any biopotentials (ECG, EMG, EEG etc.) which are recorded simultaneously. Connect to virtually any type of stimulator delivering a trigger pulse with the same width as the stimulus duration.

Item No.	Description
73-2696	Universal Isolated Stimulation Unit, 110 VAC, 60 Hz
73-0504	Universal Isolated Stimulation Unit, 230 VAC, 50 Hz

DETAILS

This unit is required to produce ungrounded (isolated or floating) stimuli and prevent interference in any biopotentials (ECG, EMG, EEG etc.) which are recorded simultaneously.

The UISO can be hooked between any stimulator and the stimulation electorde. It can be connected to virtually any type of stimulator delivering a trigger pulseand timing with the same width as the stimulus duration. The input for the trigger impulse is a BNC socket on the back plane. It can also be connected to a TTL trigger output generated by a software on a computer as a power amplifier. A switch selects the output amplitude range (0 to 50, 0 to 100 Volt). Fine adjustment is provided by the fine control on a 10-turn potentiometer. Stimuli produced can be either monopolar (positive or negative), or alternated. Alternated stimulation avoids electrode polarization. High voltages are required for field stimulation in tissue baths.

- Generates isolated stimuli in the range of 0 to 100 Volt
- Can be connected to any stimulator delivering a trigger signal and timing; the timing unit has to provide the stimulus pattern, e.g., a TTL trigger signal with the timing and pulse width; the UISO's output exactly follows this timing
- Can be used in combination with a TTL trigger output generated by computer software as a booster output

Applications:

- Electrophysiology
- In case of simultaneous biopotential recording
- Electrical stimulation of tissue in tissue baths (e.g. papillary muscle, together with intracellular action potential measurements)
- Cell stimulation in baths with field electrodes

SPECIFICATIONS

Specifications	**73-0504**	**73-2696**
Dimension (H x W x D) English	6.3 x 2.2 x 8.7 in	6.3 x 2.2 x 8.7 in
Dimensions (H x W x D) Metric	160 x 55 x 250 mm	160 x 55 x 250 mm
Stimuli Output	Constant voltage, floating, isolated	Constant voltage, floating, isolated
Stimuli Output Current	1.8 to 2 A for stimuli duration < 100 µsec, 0.5 A at 10 msec stimuli duration	1.8 to 2 A for stimuli duration < 100 µsec, 0.5 A at 10 msec stimuli duration
Stimuli Output Voltage	Two ranges 0 to 50 V, 0 to 100 V	Two ranges 0 to 50 V, 0 to 100 V
Stimuli Polarity	Positive, Negative, Alternating	Positive, Negative, Alternating
Trigger Input Impedance	10 kΩ	10 kΩ

Specifications	73-0504	73-2696
Trigger Input Width	10 μs to 10 msec defines Stimulus duration; if Trigger Signal Width exceeds 10 msec, stimuli duration is limited on 10 msec	10 μs to 10 msec defines Stimulus duration; if Trigger Signal Width exceeds 10 msec, stimuli duration is limited on 10 msec
Trigger Signal	3 to 15 V, Trigger level 1.5 V, active low or active high (can be switched internally using jumper)	3 to 15 V, Trigger level 1.5 V, active low or active high (can be switched internally using jumper)
Weight (English)	2.0 lbs	2.0 lbs
Weight (Metric)	1.3 kg	1.3 kg

Coaxial Stimulation Electrode for the Isolated Heart (Rat, Guinea-pig, Rabbit)

For electrical stimulation of the isolated perfused heart. Ensures constant heart rate.

Item No.	Description
73-3322	Link for Higher Loading Capacity, for Two Arms with 9 or 9.5 mm Maxi Balls, pkg of 1

DETAILS

Electrical stimulation of the isolated heart ensures constant heart rate. The tissue is being stimulated between the inner wire and the outer cylinder. Through the coaxial construction, the outer electrode at zero potential acts as a screen so that stray fields are reduced and interference to ECG (EG) recordings is limited. A special holder for easy positioning of the electrode on the heart surface is available as an accessory.

- For electrical stimulation of the isolated perfused heart
- Reduced stray fields for more accurate recordings

Holder with Maxi-Ball Joints for Large Stimulation Electrode includes 9 mm Ball with 130 mm length and 8 mm diameter Rod (73-3323), Maxi-Ball High Load Link (73-3322), and special bar with ball and thumbscrew.

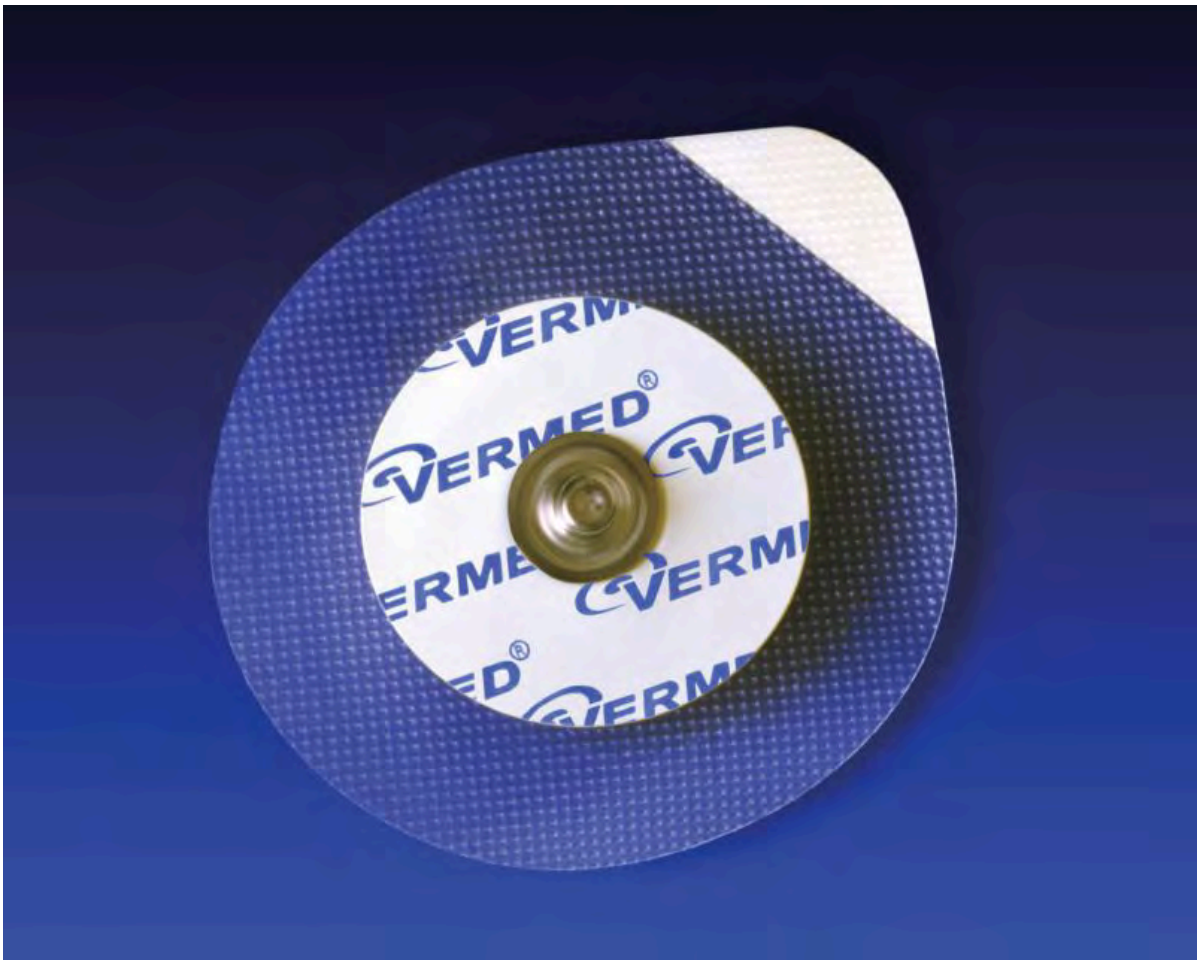
SPECIFICATIONS

Specifications	73-0219	73-3322	73-3323
Cable Length (English)	4.7 in ending on 4 mm MC Banana Plugs, 2-core screened cable		
Cable Length (Metric)	120 mm ending on 4 mm MC Banana Plugs, 2-core screened cable		
Length of Cylinder	75 mm		
Outside Diameter (OD)	4.3 mm		
Weight (Metric)	40 g, without holder		

Solid Gel General Purpose Disposable ECG Electrodes

Ideal choice for cardiac monitoring and diagnostic applications such as stress test, long term monitoring, short term monitoring or resting EKG

Item No.	Description
72-7093	Solid Gel Adhesive General Purpose Electrodes, 48 mm (1 7/8 in), pkg of 60 (5 electrodes per strip)



DETAILS

These Solid Gel General Purpose Disposable ECG Electrodes are the ideal choice for cardiac monitoring and diagnostic applications. Each Electrode is designed to work in all procedures: Stress Test, Long Term Monitoring, Short Term Monitoring or Resting EKG.

- Suitable for all types of studies
- Solid gel for improved adhesion and applications

The adhesive has a specially formulated solid gel that improves adhesion and ease of application, while reducing the need for clean-up. Electrodes are available in a 48 mm (1 7/8 in) diameter breathable tape with a stainless steel snap and are Latex-Free. They are supplied as 5 electrodes per strip in a package of 60. They attach to an alligator clip or a standard connector lead wire.

SPECIFICATIONS

Specifications	**72-7093**
Adhesive Material	Solid Gel
Diameter (English)	1 7/8 in
Diameter (Metric)	48 mm

Force Displacement Transducers, Model K1000 (1000 g-force)

Series K force transducers are universally applicable for the measurement of force. The K1000 series has a g-force of 1000.

Item No.	Description
73-0826	HSE-HA Force Transducer, K1000, for use with HSE

DETAILS

Series K force transducers are universally applicable for the measurement of force. There are 4 models, for 4 different force ranges: K30 (±30 g-force), K100 (100 g-force), K300 (300 g-forces), and K1000 (1000 g-force). The maximum displacement at the tip of the flat spring is 4 mm.

- Four ranges available
- Robust construction
- Application in teaching

SPECIFICATIONS

Specifications	73-0826	73-2679	73-2683	73-2687
Certifications	CE	CE	CE	CE
For use with X Amplifier Type	HSE	Harvard Appartus	Grass	Gould 6600
Height With Pully English	2.4	2.4	2.4	2.4
Height With Pully Metric	60	60	60	60
Height Without Pully English	0.8	0.8	0.8	0.8
Height Without Pully Metric	20	20	20	20
Input Impedance (Pins 1-5)	350 Ohm	350 Ohm	350 Ohm	350 Ohm
Mounting Rod Length English	5.1	5.1	5.1	5.1
Mounting Rod Length Metric	130	130	130	130
Mounting Rod OD English	0.25	0.25	0.25	0.25
Mounting Rod OD Metric	6	6	6	6
Natural Frequency	400 Hz	400 Hz	400 Hz	400 Hz
Output Impedance (Pins 2-4)	350 Ohm	350 Ohm	350 Ohm	350 Ohm
Resolution (Noise)	150 mg	150 mg	150 mg	150 mg
Sensitivity (Displacement)	1.2 mV/mm/V	1.2 mV/mm/V	1.2 mV/mm/V	1.2 mV/mm/V
Sensitivity (Force)	3	3	3	3
Supply Voltage	10 V max.	10 V max.	10 V max.	10 V max.
Transducer Depth English	3.3	3.3	3.3	3.3
Transducer Depth Metric	84	84	84	84
Transducer Width English	0.8	0.8	0.8	0.8
Transducer Width Metric	20	20	20	20

Specifications	73-0826	73-2679	73-2683	73-2687
Weight English	7	7	7	7
Weight Metric	200	200	200	200

HSE-HA Stimulator CS for Isolated Cells

Electrical square wave stimulator especially designed for electrical field stimulation of isolated cells, e.g. myocytes. Can be used for other stimulation applications where high currents are necessary.

- Easy to use
- Constant voltage mono-phasic, biphasic or alternating stimulation (>1 A)
- High output impulse current
- Backup memory for timing setting
- Specially designed for isolated cell stimulation

Item No.	Description
73-2667	HSE-HA Stimulator CS for Isolated Cells, 115 VAC, 60 Hz
73-0485	HSE-HA Stimulator CS for Isolated Cells, 220 VAC, 50 Hz

DETAILS

The stimulator CS Type 223 is an electronic square wave stimulator especially designed for the electrical stimulation of isolated cells, e.g. myocytes. Stimulating isolated cells needs a high impulse current to trigger a maximum of cells independent of the size, shape specially in cell culture medium having a low resistance. This is of importance in experiments where the threshold voltage of cell reaction has to be determined. To reduce electrochemistry effects such as polarization of the electrodes and double layer of gas bubbles biphasic stimulation with perfect symmetry is requested. To be able to activate an action potential by depolarizing the membrane and to avoid further influence of the stimuli on the cell reaction, short and powerful impulses are required.

- Easy to use
- Constant voltage mono-phasic, biphasic or alternating stimulation (>1 A)
- High output impulse current
- Backup memory for timing setting
- Specially designed for isolated cell stimulation

Stimulation Mode and Timing are displayed on a LCD display and can easily be set in a step through mode using the 'Menu' button and the adjust knob. The last setting of the timing is stored in a backup memory and recalled automatically after switching on the instrument. The Stimulus Output Voltage is indicated on the built-in digital voltmeter and can be adjusted with the AMPLITUDE knob on two potentiometers with adjustment in the range of 0 to 45 V. The output is floating; not connected to earth (ungrounded). The output has a very low impedance (less than 1 Ohm). To avoid overheating of the output circuit a dynamic current limiter is built in. It limits the maximum output current relative to the stimulation width.

SPECIFICATIONS

Specifications	**73-2667**	**73-0485**
Delay Time	(leading the stimuli): 2 to 50 msec (in 7 steps) 2, 5, 10, 20, 30, 40, 50 msec	(leading the stimuli): 2 to 50 msec (in 7 steps) 2, 5, 10, 20, 30, 40, 50 msec
Dimension (H x W x D) English	4.3 x 11.8 x 9.8 in	4.3 x 11.8 x 9.8 in
Dimensions (H x W x D) Metric	100 x 300 x 250 mm	100 x 300 x 250 mm
Indicators - 1	1. LCD module (4 lines of 16 characters each) to indicate stimulus parameter settings (except output voltage) 2. Digital voltmeter (DVM) to indicate output voltage setting range selectable: 0 - 50.0 V	1. LCD module (4 lines of 16 characters each) to indicate stimulus parameter settings (except output voltage) 2. Digital voltmeter (DVM) to indicate output voltage setting range selectable: 0 - 50.0 V
Indicators - 2	3. LED for stimulus pulse 4. Beep (with each stimulus pulse), can be switched off	3. LED for stimulus pulse 4. Beep (with each stimulus pulse), can be switched off
Stimulation Mode 1	SINGLE/STRT single stimulus triggered by START switch or by remote contact	SINGLE/STRT single stimulus triggered by START switch or by remote contact
Stimulation Mode 2	REPEAT/STRT repeating stimulus triggered by START switch or by remote contact	REPEAT/STRT repeating stimulus triggered by START switch or by remote contact
Stimulation Mode 3	TRIGGER pulse (TTL, negative-going edge) starts delay circuit; START switch must be in OFF position	TRIGGER pulse (TTL, negative-going edge) starts delay circuit; START switch must be in OFF position
Stimulus Output	1. Output voltage 0 to 50 V; Pulse Current up to 1 A at max. pulse width (10 msec) 2. Monophasic, Biphasic, Alternated 3. Output circuit floating, not connected to earth (ungrounded)	1. Output voltage 0 to 50 V; Pulse Current up to 1 A at max. pulse width (10 msec) 2. Monophasic, Biphasic, Alternated 3. Output circuit floating, not connected to earth (ungrounded)

Specifications	73-2667	73-0485
Timing: Stimulation Frequency	0.05 to 100 Hz (in 29 steps) 0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 Hz	0.05 to 100 Hz (in 29 steps) 0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 Hz
Timing: Stimulus Width	10 Âµsec to 10 msec (in 28 steps) 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 200, 300, 400, 500, 600, 700, 800, 900 Âµsec	10 Âµsec to 10 msec (in 28 steps) 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 200, 300, 400, 500, 600, 700, 800, 900 Âµsec
Trigger Input	BNC socket, input signal starts time delay, TTL level, negative active edge	BNC socket, input signal starts time delay, TTL level, negative active edge
Trigger Output	BNC socket, signal: delay time, open collector output (2 kΩ to +5V)	BNC socket, signal: delay time, open collector output (2 kΩ to +5V)
Weight (English)	7.7 lbs	7.7 lbs
Weight (Metric)	3.5 kg	3.5 kg

Venous Pressure Transducers (P75)

Hugo Sachs' rugged low pressure transducer is highly sensitive for research and surgical applications involving liquids or gases.

- For low pressure applications with liquids and gases ±75 mmHg
- Excellent sensitivity and baseline stability
- Applications include:
  - Venous blood pressure
  - Esophageal pressure with fluid filled catheter
  - Perfusion pressure in isolated lung and liver
  - Perfusion pressure on perfused hollow organs, such as the esophagus
- Robust construction with a removable Macrolon® dome, easy to fill, bubble free
- Transducer is a metal housing with ceramic pressure sensor giving the P75 excellent resistance to a variety of media

Item No.	Description
73-0020	P75 Venous Pressure Transducer for PLUGSYS Modules (73-0065, 73-1793) or CTA Compact Transducer Ampllifier (73-4457)
73-3738	P75 Venous Pressure Transducer for ADInstruments Bridge Amp (77-0254, 77-0256)
73-0025	Replacement Dome for Venous Blood Pressure
73-4479	Manual Pressure Calibrator, Range 0-300 mmHg

DETAILS

Hugo Sachs' rugged low pressure transducer is highly sensitive for research and surgical applications involving liquids or gases.

- For low pressure applications with liquids and gases ±75 mmHg
- Excellent sensitivity and baseline stability
- Applications include:
  - Venous blood pressure
  - Esophageal pressure with fluid filled catheter
  - Perfusion pressure in isolated lung and liver
  - Perfusion pressure on perfused hollow organs, such as the esophagus
- Robust construction with a removable Macrolon® dome, easy to fill, bubble free
- Transducer is a metal housing with ceramic pressure sensor giving the P75 excellent resistance to a variety of media

The P75 has a removable Macrolon® dome with a pressure connection and a vent connection at the side, so that it can be filled free of air bubbles. The dome connections have a male Luer taper so that suitable stopcocks can be attached. The transducer has a metal housing. The actual pressure sensor inside is

made from ceramic and therefore has excellent resistance to different media.

The transducer's rugged construction can withstand pressure overloads up to 4000 mmHg without damage. It works together with any DC bridge amplifier (e.g., PLUGSYS TAM–A).

Compatible Amplifiers & Systems

Transducer Item #	Transducer	Compatible Amplifier
73-0020	P75 for PLUGSYS	(75-0065 or 75-1793) or (73-4457)
73-0021	P75 for Harvard Apparatus Transducer Interface	(50-7970 or 50-7996)
73-0022	P75 for Grass Amplifiers	Please specify in detail type of amplifier to be used
73-0023	P75 for Gould 6600 Series	Please specify in detail type of amplifier to be used
73-3738	P75 for ADInstruments Bridge Amp	(77-0254, 77-0256)

SPECIFICATIONS

Pressure Range	±75 mmHg (±100 cmH_2O)
Volume Displacement	0.06 mm^3 /10
Linearity	±0.15 mmHg
Long Term Drift	±0.04 mmHg
Overload	-760 (=vacuum) to 4,000 mmHg
Measurement Media	All gases and liquids which are compatible with Macrolon®
Temperature Range	0 to 50°C
Zero Drift	±0.04 mmHg/10°C (0 to 50°C)
Range Drift	±0.04 mV/10°C (±0.04 mmHg/10°C) (0 to 50°C)
Electrical Data:	
Supply Voltage	5 V (4.5 to 5.5 V) DC Only
Current Loading	15 mA max.
Sensitivity	1 mV/mmHg, Nominal

Output Resistance	300 Ω, nominal
Frequency Range	0 to 100 Hz
Connection Cable	Approximately 1.5 m (4.9 ft) long
Suitable Amplifiers	Any Bridge Amp providing 5 VDC excitation voltage
Mechanical Data:	
Pressure Connections	Luer Taper, Male
Weight	0.35 kg (0.8 lb)
Dimensions, H x W x D	40 x 40 x 35 mm (1.57 x 1.57 x 1.38 in)
Mounting Rod	8 x 70 mm (0.31 x 2.76 in)

PLUGSYS Ventilation Control Module (VCM-P and VCM-R)

Produces a negative pressure at a respiratory rhythm as required for operating an isolated perfused rabbit, rat, guinea-pig, or mouse lung. Works only with HSE Lung systems IPL-1, IPL-2 or IPL-4.

Item No.	Description
73-1741	Ventilation Control Module (VCM-P); uses Integral Pump
73-1750	Timer Counter Module (TCM)

DETAILS

Ventilation Control Modules

Ventilation Control Module (VCM) has been developed especially for producing a negative pressure at a respiratory rhythm as required for operating an isolated perfused rabbit, rat, guinea-pig, or mouse lung.

The module operates with a positive pressure. The negative pressure required for ventilation is generated by means of a Venturi nozzle which is fitted in the lung apparatus (IPL-1, IPL-2, IPL-4). When used with a restrictor nozzle (positive pressure ventilation head) the module can also be employed for positive pressure ventilation during the preparation phase of the lung.

VCM-P uses an integral pump.

VCM-R uses a pressure regulated gas source (tank or house air) in the range of 2 to 8 bars.

TThe VCM-P module works independently; it requires neither a vacuum nor a compressed air supply. The module consists of an electronic and a pneumatic section. A low-noise pump stores the compressed air in a small reservoir where it is stabilized electronically. The air stream which appears at the outlet connection (TO VENTILATION HEAD) passes through adjustable valves. The air is controlled electronically according to the selected respiration rate (RATE) and the selected inspiration cycle (INSP. CYCLE%). In addition one (or several) deep breaths (DEEP INSPIRATION) can be triggered by pressing a button. The output therefore consists of a rhythmically modulated air stream at a positive pressure. By connecting it to a suitable nozzle a rhythmically modulated pressure of the desired magnitude can be produced.

The VCM-R module works only with compressed air or gas mixtures coming from a gas tank. It can be combined with a gas select module if between differnt gases for ventilation should be switched.

Timer Counter Module

The **Timer Counter Module** was designed to operate in conjunction with the HA-HSE Ventilation Control Module VCM used in all HA-HSE isolated lung apparatus from mice to rabbits.

As a timer or event counter module it generates a signal which triggers the VCM to perform a deep inspiration cycle (sigh breath). In order to prevent the slow collapse of the isolated lung during quiet respiration, a deep inspiration should be produced every 5 to 20 minutes. This results in an appreciable extension of the lifetime of the preparation. The VCM, therefore has a facility for triggering such a deep inspiration by pressing the 'DIRECT' key or at the regular intervals from the HA-HSE Timer Counter Module. Other PLUGSYS modules are also capable of responding to this output signal.

SPECIFICATIONS

VCM-P

Adjustment ranges for:

Ventilation rate	RATE: 30, 40, 50, 60, 70, 80, 90, 100 (min-1)
Inspiration time	INSP. CYCLE: 10, 20, 30, 40, 50, 60. 70. 80 (%)
Airflow at outlet	0 to 4 l/min (no back pressure)
Internal operating pressure	100 ± 5 mmHg electronically controlled
Trigger output	(BNC socket) [inspiration = low level] / [expiration = high level] TTL level (open collector) Trigger inputs / outputs through DEEP INSP.OUT (output TTL level open collector) internal jumpers to the EXP./INSP.OUT (output TTL level open collector) PLUGSYS bus DEEP INSP.IN (input TTL load resistance 2.2 kOhm)
Power supply	5 V 0.4 A, 24 V 0.4 A through connector from the PLUGSYS bus system.
Dimensions	(Module for 19 rack) width 20 E (101.6 mm), height 3 U (128.7 mm), depth Europe size (220 mm)
Connector	DIN 41612, 96-pin VG
Weight	1.8 kg

VCM-R

Adjustment ranges for

Ventilation rate	RATE: 30, 40, 50, 60, 70, 80, 90, 100 (min-1)
Inspiration time	INSP. CYCLE: 10, 20, 30, 40, 50, 60. 70. 80 (%)
Airflow at outlet	0 to 4 l/min (no back pressure)
Internal operating pressure	100 ± 5 mmHg electronically controlled
Trigger output	(BNC socket) [inspiration = low level] / [expiration = high level] TTL level (open collector) Trigger inputs / outputs through DEEP INSP.OUT (output TTL level open collector) internal jumpers to the EXP./INSP.OUT (output TTL level open collector) PLUGSYS bus DEEP INSP.IN (input TTL load resistance 2.2 kOhm)
Power supply	5 V 0.4 A, 24 V 0.4 A through connector from the PLUGSYS bus system.
Dimensions	(Module for 19 rack) width 20 E (101.6 mm), height 3 U (128.7 mm), depth Europe size (220 mm)
Connector	DIN 41612, 96-pin VG
Weight	1.8 kg

Timer Counter Module

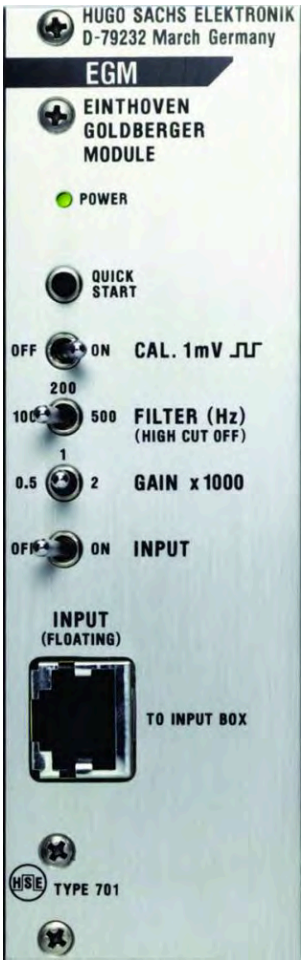
Input and Output Trigger Signals	Connections made via jumpers to trigger lines of 96-pin VG connector from internal PLUGSYS system bus
Time Mode	Deep inspiration is produced at predetermined time intervals. Quartz-controlled timer inside TCM runs down from set time to 00 and then resets counter back to selected value when 00 is reached, VCM is triggered to perform deep inspiration cycle.
Count Mode	Deep inspiration is produced after predetermined number of respiratory cycles of VCM. Respiration cycles are counted down on presetting counter inside TCM, when zero is reached, VCM is triggered to perform deep inspiration cycle and counter automatically resets to preset value
Preset	Time or event presetting is selected on two digit thumbwheel switch (00-99) mounted on front panel, time or count range can be altered with switch SEC/MIN or x1/x10 to select appropriate factor

Warning Function	TCM incorporates warning function which announcesnext triggering operation announcement activated when internal timer or counter counts last 10 seconds or respiratory cycles function is indicated visually on LED and audibly by built-in loudspeaker. Purpose of facility is to remind user that deep inspiration is coming shortly. This can be inhibited by pressing 'SKIP NEXT' key, if desired to avoid interference with any measurement during experiment.
PLUGSYS Width	1 slot unit

PLUGSYS Einthoven Goldberger Module (EGM)

Used for capturing and amplifying ECG signals after Einthoven and Goldberger lead configuration, 6-lead ECG

Item No.	Description
73-1778	Einthoven Goldberger Module (EGM)
73-1786	4-Lead ECG Input Cable with Banana Plugs to EGM (701)



DETAILS

The **Einthoven Goldberger Module** (EGM) is used for capturing and amplifying ECG signals after Einthoven and Goldberger lead configuration in the PLUGSYS system. It connects to 4 electrodes. This module has isolated input amplifiers in order to avoid hum interference.

Inputs Leads:

RA: Right Arm

LA: Left Arm

LF: Left Foot

RF Right Foot (Reference)

Output Signals: Bipolar Einthoven Extremity Leads:

I: LA(+) - RA(-)

II: LF(+) - RA(-)

III: LF(+) - LA(-)

Unipolar Goldberger Extremity Leads:

aVR RA(+) - (LA+LF)/2(-)

aVL LA(+) - (RA+LF)/2(-)

aVF LF(+) - (RA+LF)/2(-)

The 6 output voltages of the different leads can be switched through jumpers to the PLUGSYS system bus. From the system bus they can be picked off by a Recorder Output Module (ROM) for direct recording or a DAQ Hardware PLUGSYS for data acquisition by computer.

SPECIFICATIONS

Specifications **73-1778**

Calibration	Square-wave signal 1 mV 2 Hz (120 ml/min); calibration signal is activated with switch
Connector	96-pin VG connector to DIN 41612, 8-pin RJ-45
ECG Input	4-way inputs cable must be connected as follows: RA (right arm), LA (left arm), LF (left foot), RF (right foot)
ECG Leads	Bipolar extremity leads I, II and III after Einthoven as well as unipolar extremity leads aVR, aVL, and aVF after Goldberger
Gain	Setting x0.5 - 500; Setting x1 - 1000; Setting x2 - 2000

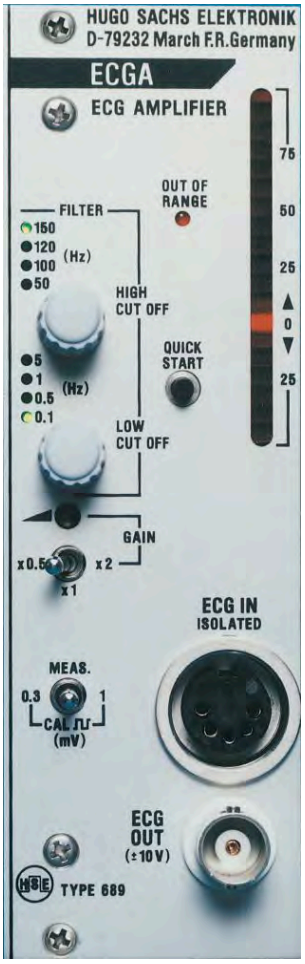
Specifications **73-1778**

High-Pass Filter	0.1 Hz, fixed
Input Cable	(Order separately) 4-way ECG input cable with needles, or 4-way ECG input cable with banana plugs, or input box with 4 + 6 inputs for stimulation use of WLA module Type 702 for 6 unipolar Wilson chest leads (V1 to V6)
Input Circuit	Isolated input circuit (floating input), isolating volt. 200 VDC max.
Input Impedance	107 ohm
Low-Pass Filter	100 Hz, 200 Hz and 500 Hz
PLUGSYS Width*	2 slot units
Power Supply	5 V 1.2 mA from PLUGSYS system bus
Recorder Output	Outputs of 6 ECG leads are linked by jumpers to PLUGSYS bus system; link to recorder is provided by Recorder Output module (ROM) installed in PLUGSYS System

PLUGSYS Electrocardiogram (ECG) Amplifier Module (ECGA)

Amplifies ECG signals up to 1,000 beats per minute

Item No.	Description
73-0149	Electrocardiogram (ECG) Amplifer Module (ECGA)
73-1494	ECG Cable with Needles for ECGA or BPA (Rodents)



DETAILS

The **Electrocardiogram (ECG) Amplifier Module** (ECGA) amplifies ECG signals. A floating input circuit is used to avoid hum and grounding problems. A bar graph display permits visualization of the ECG signal. The filters are for heart rates up to 1000 beats per minute. Both outputs can be used for recording on a chart recorder or for data acquisition. A square-wave signal generator with amplitudes of 0.3 mV and 1 mV is incorporated for calibration.

Can be used with the .

SPECIFICATIONS

Specifications **73-0149**

Calibration	Square-wave signal generator with amplitudes of 0.3 mV and 1 mV
Commond Mode Rejection	106 dB
Connector	DIN 41612, 96-pin VG
Display	Bar graph 0.75 V/LED
Filter Indication	by green LEDs on front panel
Gain Trimmer in Position x0.5	Switch in Position x0.5 1000 to 5000
Gain Trimmer in Position x1	Switch in Position x1 2000 to 10000
Gain Trimmer in Position x2	Switch in Position x2 4000 to 20000
High-Pass Filter	(LOW CUT OFF) 5 Hz, 1 Hz, 0.5 Hz, 0.1 Hz
Input	Floating differential input, isolated barrier internally clamped to 300 V, with protection against static discharges and 10 kHz input filter for h.f. suppression
Input Connector	5-pin binder socket with screw lock; pin connections correspond to those of standard 3-pin ECG input cable
Input Impedance	$10^{10}\Omega$
Low-Pass Filter	(HIGH CUT OFF) 150 Hz, 120 Hz, 100 Hz, 50 Hz
Output	BNC connector on front panel (
PLUGSYS Width	2 slot units
Power Supply	5 V/600 mA, through connector from PLUGSYS bus system

Specifications **73-0149**

Quick Start	For rapid discharge of coupling capacitors by pressing QUICK START key
Recorder Output	Internal output is connected to bus system via jumpers; ECG signal is connected to recorder via Recorder Output Module (ROM); also possible to connect recorder directly to BNC connector 'ECG OUT' at front panel

Einthoven Goldberger and Wilson Lead Amplifier Module Accessories

Einthoven Goldberger and Wilson Lead Amplifier Module Accessories

Item No.	Description
73-0200	Contact ECG Electrode, Silver Chloride Pellet
73-0550	ECG Electrode Insert for 12-Lead ECG Recording
73-1789	Input Box for up to 12 ECG Channels (no MAP), for PLUGSYS EGM and WLA Modules, with Connection Cables

DETAILS

The ECG Recording Electrode and Insert and the Input Box are for use with the Einthoven Goldberger Module (EGM) and the Wilson Lead Amplifier Module (WLA). Mini ECG electrodes are mounted on an insert. The insert has been designed for multi-lead ECG recording on large hearts like Rabbit, it has all the features to be mounted on the IH-5. The electrodes can individualy be adjusted to be as near as possible to the heart surface.Depending on the number of electrodes installed it is possible to mimic an “EINTHOVEN”derivation as well as “WILSON” V1-V6 unipolar leads. The electrodes are connected to the input box of the EGM and WLA PLUGSYS amplifier.

Input Box Type 701/2 will accept up to 12-Lead (10-Wire) ECG only. The Input Box includes EGM and WLA module connection cables.

PLUGSYS Electromyogram (EMG) Amplifier Module (EMGA)

Used to amplify EMG signals in the PLUGSYS system

Item No.	Description
73-1766	Electromyogram (EMG) Amplifier Module (EMGA)

DETAILS

This **Electrolyogram (EMG) Amplifier Module** (EMGA) is to amplify EMG signals in the PLUGSYS system. A floating input circuit is used to avoid hum and grounding problems. The filters are designed for EMG signals up to 10 kHz. The analog EMG signal is available at a BNC connector on the front panel and also internally on the PLUGSYS system bus. Both outputs can be used for recording on a chart recorder or for data acquisition. A square-wave signal generator with 0.3 mV and 1 mV amplitude is incorporated for calibration. For EMG integration an envelope integration circuit is provided. This signal is also available on the front panel and on the PLUGSYS bus.

SPECIFICATIONS

Specifications	73-1766
Calibration	Square-wave signal generator with amplitudes of 0.3 mV and 1 mV amplitude
Commond Mode Rejection	106 dB
Connector	DIN 41612, 96-pin VG
Display	Bar graph 0.75 V/LED
Filter Indication	By green LEDs on front panel
Gain Trimmer in Position x0.5	Switch x1 x10 x100 In Position x0.5 100 to 500 1000 to 5000 10000 to 50000
Gain Trimmer in Position x1	Switch x1 x10 x100 In Position x1 200 to 1000 2000 to 10000 20000 to 100000

Specifications **73-1766**

Gain Trimmer in Position x2	Switch x1 x10 x100 In Position x2 400 to 2000 4000 to 20000 40000 to 200000
High-Pass Filter	(LOW CUT OFF) 50 Hz, 25 Hz, 10 Hz, 2 Hz
Input	Floating differential input, isolated barrier internally clamped to 300 V, with protection against static discharges and 10 kHz input filter for h.f. suppression
Input Connector	5-pin binder socket with screw lock; pin connections correspond to those of standard 3-pin EMG input cable
Input Impedance	$10^{10}\Omega$
Low-Pass Filter	(HIGH CUT OFF) 10 kHz, 3 kHz, 1 kHz, 0.3 kHz
Output	BNC connector on front panel for EMG and envelope signal (
PLUGSYS Width	2 slot units
Power Supply	5 V/600 mA, through connector from PLUGSYS bus system
Quick Start	For rapid discharge of coupling capacitors by pressing QUICK START key
Recorder Output	Internal outputs are connected to bus system via jumpers; EMG signal and envelope signal are connected to recorder via Recorder Output Module (ROM).
Recorder Output 2	Also possible to connect recorder directly to BNC connectors 'EMG OUT' and 'Envelope Integration' at front panel

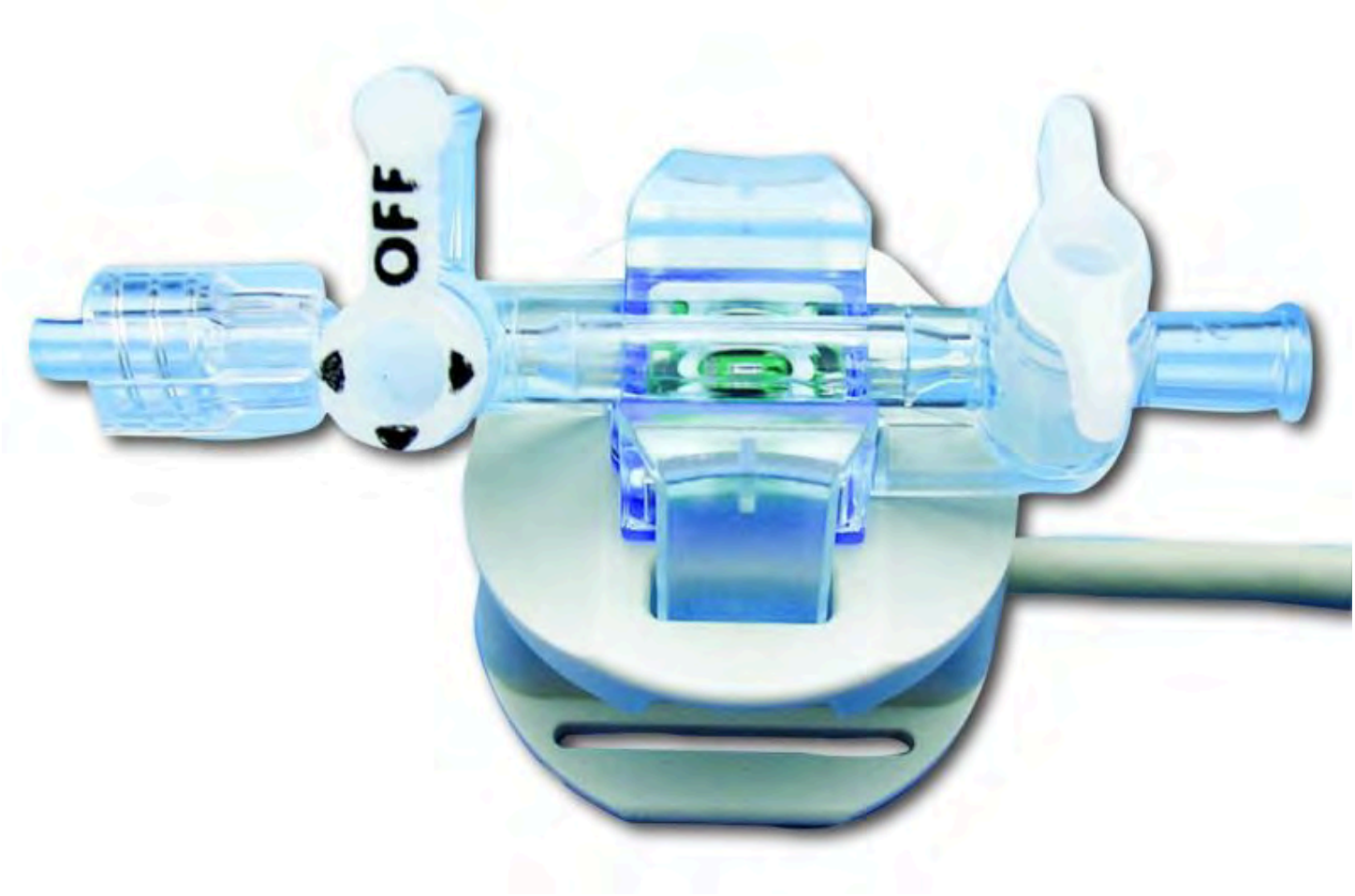
Blood Pressure Transducers (APT300)

Inexpensive pressure transducer used to measure arterial blood pressures in all species, even on mice with a high heart rate.

- Inexpensive, reliable and accurate
- Low volume displacement
- Suitable for virtually all arterial pressure applications
- Easy to fill
- Stopcocks included
- Simple holder for rod mounting

Item No.	Description
73-3862	APT300 Pressure Transducer for PLUGSYS Modules (73-0065, 73-1793) or CTA Compact Transducer Ampllifier (73-4457)
73-3866	APT300 Pressure Transducer for ADInstruments Bridge Amp (77-0254, 77-0256)
73-4905	APT300 Pressure Transducer for Small Animal Physiological Monitoring System (75-1500, 75-1501)
73-3860	Replacement Cable with Contact Plate for PLUGSYS TAM Amplifier
73-3861	Replacement Transducer Head for APT300 Transducer
73-3868	Holder for APT300 Transducer, 8 mm Rod, Length 160 mm
73-3869	Holder for APT300 Transducer, 8 mm Rod, Length 75 mm

Item No.	Description
73-0566	Plexiglass Block Clamp for mounting 73-0562 Bar onto Lab Stand
73-0500	Lab Stand with Triangular Base Plate, 30 cm Rod Length (one block clamp included)
73-4479	Manual Pressure Calibrator, Range 0-300 mmHg



DETAILS

This APT300 Transducer is an inexpensive pressure transducer which can be used to measure arterial blood pressures in all species, even on mice with a high heart rate. This transducer is typically used for arterial pressure measurement in vivo, perfusion pressures in isolated perfused organs such as heart or kidney, Isovolumetric Left Ventricular (using a balloon) pressures in isolated hearts from mice up to rabbits or pigs.

- Inexpensive, reliable and accurate

- Low volume displacement
- Suitable for virtually all arterial pressure applications
- Easy to fill
- Stopcocks included
- Simple holder for rod mounting

The APT300 Transducer consists of a contact plate with cable and the exchangeable transducer head, which can easily be replaced. Contact plates with cables for different amplifiers are available.

Compatible Amplifiers & Systems

Transducer Item #	**Transducer**	**Compatible Amplifier**
73-3862	APT300 for PLUGSYS	(75-0065 or 75-1793) or (73-4457)
73-3863	APT300 for Harvard Apparatus Transducer Interface	(50-7970 or 50-7996)
73-4905	APT300 for Small Animal Physiological Monitoring System	(75-1500 or 75-1501)
73-3864	APT300 for Grass Amplifiers	Please specify in detail type of amplifier to be used
73-3865	APT300 for Gould 6600 Series	Please specify in detail type of amplifier to be used
73-3866	APT300 for ADInstruments Bridge Amp	(77-0254, 77-0256)

SPECIFICATIONS

Operating Pressure	-300 to +300 mmHg
Overpressure	4000 mmHg
Sensitivity	5 µV/V/mmHg (±1%)
Temperature Coefficient	0.1%/°C
Zerodrift	<0.2 mmHg/°C
Zero Offset	<25 mmHg
Excitation Voltage	2 to 15 VDC (or AC up to 5 kHz)
Isolation Against Fluid	>5,000 V
Operating Temperature	15° to 40°C
Storage Temperature	-25° to 70°C

Volume Displacement	<0.04 mm^3 /100 mmHg
Output Impedance	365 Ω ±1%
Frequency Response	>1 kHz
Cable Length	3 m (9.8 ft)
Certifications	CE

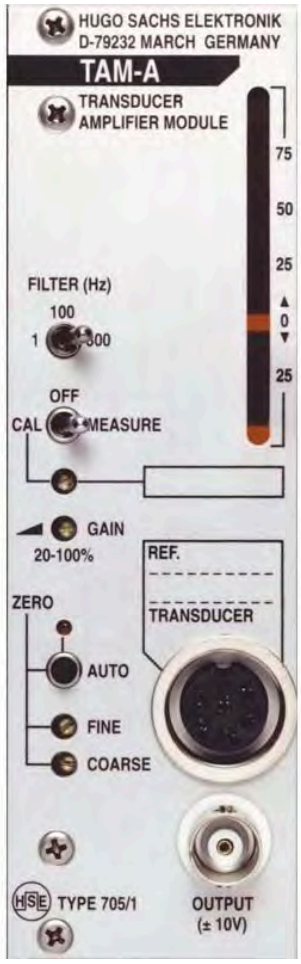
PLUGSYS Transducer Amplifier Modules (TAM-A and TAM-D)

Universal DC bridge amplifiers used to amplify physiological signals such as blood pressure, contraction force or contraction displacement.

Use with .

Please see Description for a list of recommended transducers.

Item No.	Description
73-1793	Transducer Amplifier Module (TAM-D)
73-0065	Transducer Amplifier Module (TAM-A)



DETAILS

The **Transducer Amplifier Module** (TAM) is a DC bridge amplifier. It is used to amplify signals like pulsatile blood pressures, respiratory airflow, airway pressures, contraction force and contraction displacement using transducers based on a resistive Wheatstone bridge. Transducers with a built-in preamplifier which have a high level DC output voltage can also be connected. Use with .

Choose from:

- **TAM-A** (analog): The TAM-A is equipped with an analog LED bar graph signal indicator and is best suited for applications which require the monitoring of dynamic signals, e.g. pulsatile blood pressures, respiratory airflow, airway pressures, contraction force or contraction displacement on tissue studies.

- **TAM-D** (digital display): The TAM-D has a digital numeric display and is best suited for applications with slowly changing low pulsatile signals, e.g. constant blood pressures, slow isometric or isotonic contractions, intracranial pressure or venous blood pressures. It can be paired with our and a constant pressure enabled syringe or analog speed controllable peristaltic pump to complete a constant pressure perfusion setup.
- **TAM-A Modified**: With modified low pass filter 10, 30 and 50 Hz, LED bargraph display

Recommended Transducers

- Arterial blood pressure:
- Intracardial left ventricular pressures: Millar Tip Catheters
- Venous blood pressure:
- Respiratory air flow:
- Tracheal pressure:
- Respiratory pressures:
- Contraction force:
- Displacement:

SPECIFICATIONS

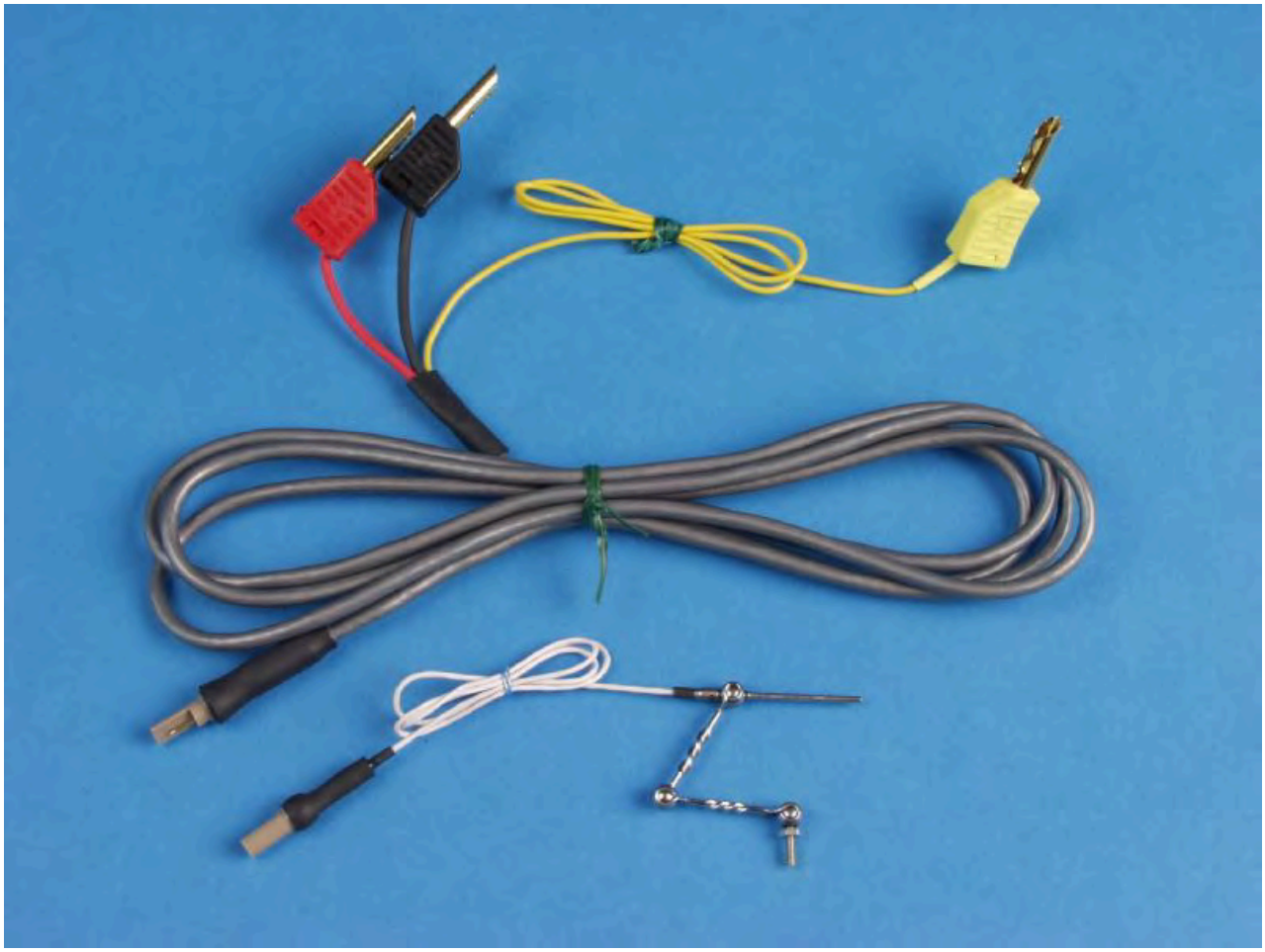
Specifications	**73-1793**	**73-0065**
Analog Indication	TAM-A LED bar graph 20 LEDs (+13/-7) for visual check on the signal sensitivity approx. 1V/LED TAM-D 3 1/2-digit LED display	TAM-A LED bar graph 20 LEDs (+13/-7) for visual check on the signal sensitivity approx. 1V/LED TAM-D 3 1/2-digit LED display

Specifications	73-1793	73-0065
Bridge Balance	Through 10-turn trimmer coarse adjustment and electronic autozero by push button (LED for error if autozero is not possible)	Through 10-turn trimmer coarse adjustment and electronic autozero by push button (LED for error if autozero is not possible)
Bridge Supply Voltage	+5V / 50 mA max.	+5V / 50 mA max.
Electrical Calibration	Selectable by switch on front panel: a) 0 V output signal with switch in position '0' b) Positive or negative calibration output voltage adjustable with 10-turn trimmer if switch is in position 'CAL'	Selectable by switch on front panel: a) 0 V output signal with switch in position '0' b) Positive or negative calibration output voltage adjustable with 10-turn trimmer if switch is in position 'CAL'
Gain	Selectable ranges by internal Jumper: 0.2 to 10, 0.4 to 20, 1 to 50, 2 to 100, 4 to 200, 10 to 500, 20 to 1000, 100 to 5000, 200 to 10000. Fine Adjustment Through 10-Turn Trimmer	Selectable ranges by internal Jumper: 0.2 to 10, 0.4 to 20, 1 to 50, 2 to 100, 4 to 200, 10 to 500, 20 to 1000, 100 to 5000, 200 to 10000. Fine Adjustment Through 10-Turn Trimmer
Output Low-Pass Filter	a) Selectable by switch on front panel for pulsatile output signal: 1, 100, 300 Hz b) Selectable by internal jumper for mean output signal: 0.1, 0.3 Hz	a) Selectable by switch on front panel for pulsatile output signal: 1, 100, 300 Hz b) Selectable by internal jumper for mean output signal: 0.1, 0.3 Hz
PLUGSYS Width*	2 slot units	2 slot units
Power Supply	+5V through connector from PLUGSYS bus system	+5V through connector from PLUGSYS bus system
Signal Output	a) On front panel through BNC socket	a) On front panel through BNC socket
Transducer Input	6-pin socket with screw lock (binder, Amphenol Tuchel) Differential input circuit, imput impedance 1010?	6-pin socket with screw lock (binder, Amphenol Tuchel) Differential input circuit, imput impedance 1010?

Small Stimulation Electrode Set (Mice)

This stimulation electrode set is used for electrical stimulation of small heart or tissues. Through the coaxial construction, the other electrode at zero potential acts as a screen so that stray fields are reduced and interference to recordings is limited (ECG, MAP). In combination with the mini ball joint holders a precise fixation on the myocard is possible.

Item No.	Description
73-0160	Small Stimulation Electrode Set, Includes 73-0181 and 73-0182
73-0181	Mini Coaxial Stimulation Electrode with modified Lemosa connector
73-0182	Adapter Cable - modified Lemosa connector to 4 mm Banana Plugs, 1.5 mm cable length



DETAILS

This stimulation electrode set is used for electrical stimulation of small heart or tissues. Through the coaxial construction, the other electrode at zero potential acts as a screen so that stray fields are reduced and interference to recordings is limited (ECG, MAP). In combination with the mini ball joint holders a precise fixation on the myocard is possible.

SPECIFICATIONS

Specifications	73-0160	73-0181
Cable Length (Metric)	35 cm	35 cm
Connector	Modified Lemo	Modified Lemo
Outside Diameter (OD)	1.3 mm	1.3 mm
Tip Length	20 mm	20 mm

PLUGSYS pH Measurement Module (pHMM)

Used to measure pH with pH glass electrodes, primarily in biological fluids such as perfusate for isolated perfused organs.

Item No.	Description
73-0215	pH Measurement Module (pHMM)

DETAILS

The **pH Measurement Module** (pHMM) is used to measure pH with pH glass electrodes. The main application is continuously pH recording with the combination pH electrodes for measurement in biological fluids such as perfusate for isolated perfused organs.

The input circuit of the module includes an isolation amplifier (potential separation between sensing electrode and circuit ground of the PLUGSYS measuring system) to avoid measurement errors due to ground loops and leakage currents.

SPECIFICATIONS

Input Connector	Isolated BNC connector
pH Range	0 to 14
Resolution	0.01 pH
Output	1 V per 1 pH on BNC connector on front panel (±10 V); output voltage is also available on PLUGSYS bus
Slope Adjustment	2 point adjustment using calibrated buffer solutions
Simulation	Physiological measuring range for calibrating recording output can be simulated using 2 corresponding push buttons; each simulated value can be adjusted in pH range of 0 to 14
PLUGSYS Width	2 slot units
Connector	DIN 41612, 96-pin VG

PLUGSYS pH Control Module (pHCM)

Used for maintaining a constant pH of biological solutions in perfusion systems. Used in conjunction with the pHMM (73-0215).

Item No.	Description
73-1776	pH Control Module (pHCM)

DETAILS

The **pH Control Module** (pHCM) is used for maintaining a constant pH in perfusion systems. It can only be used in conjunction with pHMM (73-0215) in the PLUGSYS system.

The main application is in ensuring a constant pH of biological solutions, as e.g. the perfusate of isolated organs as isolated lung, heart, liver, kidney or isolated tissues.

To control the pH a gas (commonly CO_2) flow bubbling through the perfusion solution is switched on and off. Fine adjustment of the rate of gas flow is by a built-in needle valve. The required pH value and the permitted fluctuations (Hysteresis) can be adjusted on trimmer potentiometers and can be indicated on the corresponding pHMM module by pressing a key.

SPECIFICATIONS

Control Range, Setting	SET POINT is adjustable between approx. pH 6.5 and pH 8.5; set value is indicated on pHMM module by pressing DISPLAY key
Differential, HYST	Adjustable between approx. 0.02 to 1 pH units; setting is indicated on pHMM module by pressing DISPLAY key
Controlled Medium (Gas)	Depends on perfusion solution used and on control direction; when used on Krebs-Henseleit solution where pH has to be reduced: CO_2 gas
Required Condition of Controlled Medium (Gas)	Dirt particle size 25 µm max., dry gas pressure 2 bar maximum
Gas Flow	Continuously adjustable
PLUGSYS Width	1 slot unit
Connector	10-way ribbon cable to pHMM module

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