

# MPS450

## Patient Simulator

### Technical Data



The portable MPS450 is Fluke Biomedical's next-generation multiparameter patient simulator. Designed to evaluate the simplest ECG monitor to the most complex arrhythmia detection system, the MPS450 provides a broad range of physiological waveforms for comprehensive equipment testing and training.

The MPS450 features multiple simulations for ECG, blood pressure, respiration, temperature, pacemaker, artifact, and arrhythmia conditions. Optional features include cardiac-output and fetal/maternal ECG simulation.

Microprocessor control, combined with extensive digital memory, makes testing quick and convenient. A menu-driven interface provides an intuitive method to get around the multitude of tests and functions, and the tool's large, bright display makes reading test results easy. Compact and portable, the MPS450 is ideal for mobile technicians, whether they need to do a quick check on a bedside monitor or perform a complete PM on the latest patient-monitoring system.

The MPS450 is also an excellent training tool that teaches techniques for recognizing normal and abnormal conditions in the heart, lungs, and circulatory system, as well as techniques for CPR, defibrillation, and cardioversion. Cardiac physiologists learn how to interpret ECG waveforms, and respiratory physiologists learn pulmonary and respiratory analysis techniques.

#### Key features

- 12-lead ECG simulation
- 36 arrhythmia selections
- Pacemaker simulation
- 4 invasive blood-pressure channels, including Swan-Ganz
- Respiration and temperature simulation
- Blood pressure synchronization with ECG
- Large, bright 4-line by 20-character super-twist display
- Compact and portable
- Battery operated

- High-level ECG output
- Intuitive interface
- R-wave detection test
- RS-232 port for computer control

#### Optional features

- Cardiac-output simulation
- Fetal/maternal ECG, direct simulations with intrauterine-pressure waveform
- Remote controller HHC3 (Handheld Controller)

## Specifications

<b>Normal-sinus-rhythm waveform</b>	
<b>ECG reference</b>	ECG amplitudes specified for lead II (calibration), from baseline to peak of R-wave; other leads proportional
<b>Normal sinus rhythm</b>	12-lead configuration with independent outputs referenced to right leg (RL); output to 10 universal ECG jacks, color-coded to AHA and IEC standards
<b>Low-level amplitude</b>	0.05 mV to 0.50 mV (0.05-mV steps); 0.5 mV to 5.5 mV (0.5-mV steps; power-on default: 1 mV)
<b>Amplitude accuracy</b>	± 2 % of setting lead II
<b>High-level output (available on BP3 connector)</b>	0.2 V/mV ± 5 % of the ECG-amplitude setting
<b>ECG rate</b>	30, 40, 45, 60, 80, 90, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280 and 300 BPM (power-on default: 80 BPM)
<b>Rate accuracy</b>	± 1 % of setting
<b>ECG-waveform selection</b>	Adult (80 ms) or pediatric (40 ms) QRS duration (power-on default: adult QR/P-R interval of 0.16 s)
<b>Superimposed artifact</b>	50 Hz and 60 Hz, muscle, baseline wander, respiration
<b>ST-segment elevation/depression</b>	Adult mode only: -0.8 mV to 0.8 mV, in 0.1-mV steps; additional steps: 0.05 mV and -0.05 mV (power-on default: elevation 0 mV)
<b>Pacemaker waveform</b>	
<b>Pacer-pulse amplitude</b>	1 mV, 2 mV, 5 mV, 10 mV, ± 10 % (power-on default: 5 mV)
<b>Pacer-pulse width</b>	0.1 ms, 0.5 ms, 1 ms, 1.5 ms, 2 ms, ± 5 % (power-on default: 1 ms)
<b>Pacing rate</b>	75 BPM
<b>Waveforms</b>	(Power-on default: atrial waveform), atrial, asynchronous 75 BPM, demand with frequent sinus beats, demand with occasional sinus beats, AV sequential, noncapture (one time), nonfunction
<b>Arrhythmias</b>	
<b>Baseline NSR</b>	80 BPM
<b>PVC focus</b>	Left focus, standard timing (except where specified)
<b>Supraventricular arrhythmias</b>	(Power-on default: atrial fibrillation, coarse); atrial fibrillation, coarse; atrial fibrillation, fine; atrial flutter; sinus arrhythmia; missed beat (one time); atrial tachycardia; paroxysmal atrial tachycardia (PAT); nodal rhythm; supraventricular tachycardia
<b>Premature arrhythmias (all one-time events)</b>	(Power-on default: premature atrial contraction); premature atrial contraction (PAC); premature nodal contraction (PNC); PVC1 left ventricular; PVC1 left ventricular, R on T; PVC2 right ventricular; PVC2 right ventricular, early; PVC2 right ventricular, R on T; multifocal PVCs
<b>Ventricular arrhythmias</b>	(Power-on default: PVCs 6/min); PVCs 6/min (power-on default); PVCs 12/min; PVCs 24/min; frequent multifocal PVCs; bigeminy; trigeminy; multiple PVCs (one-time run of 2PVCs); multiple PVCs (one-time run of 5 PVCs); multiple PVCs (one-time run of 11 PVCs); ventricular tachycardia; ventricular fibrillation, coarse; ventricular fibrillation, fine; asystole
<b>Conduction defects</b>	(Power-on default: first-degree heart block), first-degree heart block, second-degree heart block, third-degree heart block, right-bundle-branch block, left-bundle-branch block

<b>ECG-performance testing</b>	
<b>Amplitude</b>	0.05 mV to 0.5 mV (0.05-mV steps); 0.5 mV to 5.5 mV (0.5-mV steps) (power-on default: 1 mV)
<b>Pulse wave</b>	30 BPM, 60 BPM, with 60 ms pulse width
<b>Square wave</b>	2 Hz, 0.125 Hz (power-on default: 2 Hz)
<b>Triangle wave</b>	2 Hz, 2.5 Hz
<b>Sine wave</b>	0.5 Hz, 5 Hz, 10 Hz, 40 Hz, 50 Hz, 60 Hz, and 100 Hz
<b>R-wave-detection waveform</b>	Haver-triangle R-wave rate: 30 BPM, 60 BPM, 80 BPM, 120 BPM, 200 BPM, and 250 BPM (power-on default: 60 BPM) R-wave width: 20 ms to 200 ms (10-ms steps); additional steps: 8 ms, 10 ms, and 12 ms (power-on default: 10 ms)
<b>Rate accuracy</b>	1 %
<b>Amplitude accuracy</b>	± 2 %, lead II (exception: ± 5 % for R-waves ≤ 20 ms)
<b>Respiration</b>	
<b>Rate</b>	0 (OFF), 15 BrPM, 20 BrPM, 30 BrPM, 40 BrPM, 60 BrPM, 80 BrPM, 100 BrPM, and 120 BrPM (power-on default: 20 BrPM)
<b>Impedance variations (<math>\Delta\Omega</math>)</b>	0.2 $\Omega$ , 0.5 $\Omega$ , 1 $\Omega$ , or 3 $\Omega$ (power-on default: $\Delta$ 1 $\Omega$ )
<b>Accuracy delta</b>	± 10 %
<b>Baseline</b>	500 $\Omega$ , 1000 $\Omega$ , 1500 $\Omega$ , and 2000 $\Omega$ , leads I, II, III (power-on default: 1000 $\Omega$ )
<b>Accuracy baseline</b>	± 5 %
<b>Respiration lead</b>	LA or LL (power-on default: LA)
<b>Apnea selection</b>	12 s, 22 s, or 32 s (one-time events), or continuous (apnea ON = respiration OFF; power-on default: 12 s apnea)
<b>Blood pressure</b>	
<b>Input/output impedance</b>	300 $\Omega$ ± 10 %
<b>Exciter-input range</b>	2 V rms to 16 V rms
<b>Exciter-input-frequency range</b>	DC to 5000 Hz
<b>Transducer sensitivity</b>	5 $\mu$ V/V/mmHg or 40 $\mu$ V/V/mmHg (power-on default: 5 $\mu$ V/V/mmHg)
<b>Pressure accuracy</b>	± (2 % of setting + 2 mmHg)
<b>Static levels, P1</b>	-10 mmHg, 0 mmHg, 80 mmHg, 160 mmHg, 240 mmHg, 320 mmHg, and 400 mmHg (power-on default: 0 mmHg)
<b>Static levels, P2</b>	-10 mmHg, 0 mmHg, 50 mmHg, 100 mmHg, 150 mmHg, 200 mmHg, and 240 mmHg (power-on default: 0 mmHg)
<b>Static levels, P3</b>	-5 mmHg, 0 mmHg, 20 mmHg, 40 mmHg, 60 mmHg, 80 mmHg, and 100 mmHg (power-on default: 0 mmHg)
<b>Static levels, P4</b>	-5 mmHg, 0 mmHg, 20 mmHg, 40 mmHg, 60 mmHg, 80 mmHg, and 100 mmHg (power-on default: 0 mmHg)
<b>Dynamic waveforms, P1</b>	Arterial: 120/80 Radial artery: 120/80 Left ventricle: 120/00 Right ventricle: 25/00

<b>Dynamic waveforms, P2</b>	Arterial: 120/80 Radial artery: 120/80 Left ventricle: 120/00 Right atrium (central venous or CVP): 15/10 Right ventricle: 25/00 Pulmonary artery: 25/10 Pulmonary-artery wedge: 10/2 Left atrium: 14/4
<b>Dynamic waveforms, P3</b>	Arterial: 120/80 Radial artery: 120/80 Left ventricle: 120/00 Right atrium (central venous or CVP): 15/10 Right ventricle: 25/00 Pulmonary artery: 25/10 Pulmonary-artery wedge: 10/2 Left atrium: 14/4
<b>Dynamic waveforms, P4 (Swan-Ganz sequence)</b>	Right atrium (CVP) Right ventricle (RV) Pulmonary artery (PA) Pulmonary-artery wedge (PAW)
<b>Respiration artifact</b>	BP delta change from 3 mmHg to 16 mmHg
<b>BP output</b>	Mini DIN 7-pin
<b>Temperature</b>	
0 °C (32 °F), 24 °C (75.2 °F), 37 °C (98.6 °F), and 40 °C (104 °F) (power-on default: 32 °F/0 °C)	
<b>Accuracy</b>	± 0.1 °C
<b>Compatibility</b>	Yellow Springs, Inc. (YSI) Series 400 and 700
<b>Output</b>	Mini DIN 7-pin
<b>Cardiac output (Thermodilution method, optional)</b>	
<b>Catheter type</b>	Baxter Edwards, 93a-131-7f
<b>Calibration coefficient</b>	0.542 (0 °C injectate), 0.595 (24 °C injectate)
<b>Blood temperature</b>	37 °C (98.6 °F) ± 2 %
<b>Injectate volume</b>	10 cc
<b>Injectate temperature</b>	0 °C or 24 °C ± 2 % value (power-on default: 0 °C injectate)
<b>Cardiac output</b>	2.5 lpm, 5 lpm, 10 lpm ± 5 % (power-on default: 2.5 lpm)
<b>Faulty-injection curve</b>	(Waveform for simulation available)
<b>Left-to-right-shunt curve</b>	(Waveform for simulation available)
<b>Calibrated pulse</b>	1.5 ° for 1 s (37 ° * 35.5 °) (waveform for simulation available)
<b>Repeatability</b>	± 1 %

<b>Fetal/maternal ECG (optional)</b>	
<b>Maternal heart rate (fixed)</b>	80 BPM
<b>Fetal heart rate (selectable)</b>	60 BPM, 90 BPM, 120 BPM, 140 BPM, 150 BPM, 210 BPM, and 240 BPM (power-on default: 120 BPM)
<b>Fetal heart rate (IUP)</b>	140 BPM at beginning, then varying with pressure
<b>Intrauterine-pressure waveforms</b>	Acceleration (140 BPM to 175 BPM to 140 BPM; rate change lagging IUP contraction by 30 s); early deceleration (140 BPM to 100 BPM to 140 BPM; no IUP lag time); late deceleration (140 BPM to 100 BPM to 140 BPM, starting at IUP peak)
<b>Wave duration</b>	90 s, bell-shaped pressure curve, from 0 mmHg to 90 mmHg and returning to 0 mmHg, $\pm$ 4 mmHg (max)
<b>IUP period</b>	2 min, 3 min, or 5 min; and manual
<b>Computer setup</b>	
<b>Port</b>	Bidirectional (data communications equipment) RS-232
<b>Baud rate</b>	9600
<b>Parity</b>	None
<b>Stop bits</b>	1
<b>Data bits</b>	8
<b>Temperature</b>	
<b>Operating</b>	10 °C to 40 °C (50 °F to 104 °F)
<b>Storage</b>	-25 °C to 50 °C (13 °F to 122 °F)
<b>Humidity</b>	80 % max relative humidity
<b>General information</b>	
<b>Battery replacement</b>	Warning for low-battery condition (batteries to be replaced at this time)
<b>Power</b>	Two 9 V alkaline batteries (8 hours min continuous power); optional battery eliminator 9 V dc, 50 mA
<b>Dimensions (WxDxH)</b>	15.2 cm x 19 cm x 5 cm (6 in x 7.5 in x 2 in)
<b>Weight</b>	0.7 kg (1.5 lb)

## Ordering information

### Model

**MPS450** MPS450 (base model)  
**MPS450-01** Australia  
**MPS450-02** Denmark  
**MPS450-03** India  
**MPS450-04** Israel  
**MPS450-05** Italy  
**MPS450-06** Schuko  
**MPS450-07** Switzerland  
**MPS450-08** United Kingdom  
**MPS450-09** Brazil  
**MPS450-CO** MPS450 (base model plus cardiac-output simulation)  
**MPS450-CO-01** Australia  
**MPS450-CO-02** Denmark  
**MPS450-CO-03** India  
**MPS450-CO-04** Israel  
**MPS450-CO-05** Italy  
**MPS450-CO-06** Schuko  
**MPS450-CO-07** Switzerland  
**MPS450-CO-08** United Kingdom  
**MPS450-CO-09** Brazil  
**MPS450-FET** MPS450 (base model plus direct fetal/maternal ECG simulations)  
**MPS450-FET-01** Australia  
**MPS450-FET-02** Denmark  
**MPS450-FET-03** India  
**MPS450-FET-04** Israel  
**MPS450-FET-05** Italy  
**MPS450-FET-06** Schuko  
**MPS450-FET-07** Switzerland  
**MPS450-FET-08** United Kingdom  
**MPS450-FET-09** Brazil  
**MPS450-CO/FET** MPS450 (base model plus cardiac-output and direct fetal/maternal ECG simulations)  
**MPS450-CO/FET-01** Australia  
**MPS450-CO/FET-02** Denmark  
**MPS450-CO/FET-03** India  
**MPS450-CO/FET-04** Israel  
**MPS450-CO/FET-05** Italy  
**MPS450-CO/FET-06** Schuko  
**MPS450-CO/FET-07** Switzerland  
**MPS450-CO/FET-08** United Kingdom  
**MPS450-CO/FET-09** Brazil

### Standard accessories

**9508-0301** User Manual  
**BEUNVSL IEC320C14P** AC Battery Eliminator

### Optional accessories

**9530-0072** Soft-Sided Vinyl Carrying Case  
**75034** Serial Cable D9M-D9F  
**HHC3** HHC3 Handheld Controller  
**5180500** Cardiac-Output Adapter Box

HHC3



MPS450 optional accessories



### Cardiac output adapters

**3010-0650FG** GE Medical/Marquette cardiac output cable interface cable for GE Medical/Marquette pl. monitors (includes in-line switch box to select injectate temperature) (MPS450)  
**3010-0285** HPT-2 Temperature adapter (Hewlett Packard/Philips) (2 pin)  
 (COA-1 also required for cardiac output simulation on HP patient-monitoring systems)  
**3010-0284** COA-1 Cardiac output adapter (HPT-2 also required for cardiac output simulation on patient-monitoring systems)  
**5183004FG** Universal injectate temperature adapter pigtail (unterminated)  
**5183006FG** Universal BP adapter (pigtail/unterminated)  
**5183020** Vitastat, (5 pin)  
**Optional temperature cables**  
**TEMP CABLE** Temperature cable YSI-400 series, 1/4" phone plug  
**5183002FG** Temperature cable YSI-700 series, 1/4" phone plug  
**17445** Temp cable, unterminated (universal YSI-400/700)  
**Optional blood pressure cables**  
**17434** Burdick (10 socket)  
**17460** BCI International TK-1, (6M)  
**5183006FG** BP/Toco, unterminated, PS-420/440//320  
**5183024** Corometrics (3 pin/3 socket)

**17486** Corometrics ext toco simulation  
**17460** Criticare TK-1, (6M)  
**17460** Critikon-Dynamap Plus (6M)  
**5183008** Capital Datascope, (6 socket)  
**17434** Datex- PB-2, AS/3, CS/3, Compact, Cardiocap II, Critical Care, Light (10F)  
**17460** Drager-TK-1, (6M)  
**17474** Fukuda Denshi- FD-2, PS-420\440, DS3300 (12M)  
**5183012** BP CABLE HP 12-PIN  
**MPS450-4401** HP/Philips 5UV/V IUP  
**17487** HP/Ag/Philips (50 & 8040 Series) iup toco simulation cable PS-320  
**17460** Invivo Research TK-1, (6M)  
**17460** Ivy Biomedical TK-1, (6M)  
**5183008** Kontron/Roche, (6 socket)  
**5183027FG** Marquette 7000, (8 pin)  
**3010-0671FG** GE Medical/Marquette Eagle, Tram scope, (11 pin)  
**17460** Medical data Electronics (MDE) BP cable, (6 pin)

**5183011** Mennen Medical, (6 pin)  
**17429** Nihon Kohden-NK-1, (5M)  
**17460** North American Drager, (6 pin)  
**5183024** Novamatrix, (3 pin/3 socket)  
**17460** Ohmeda, (6 pin)  
**17460** Physio-Control-TK-1, (6M)  
**17460** Protocol Systems-TK-1, (6M)  
**17434** Puritan Bennett-PB-2, Puritan Bennett, (10F)  
**17468** Siemens-SM-1, Micor/Mingo (15M)  
**17406** Siemens-SM-1, (use with Siemens Medical Transducer Adapter (3368-383-E530U) to run a single invasive BP channel on Siemens Medical SC6000 and SC9000 series monitors), Sirecust Series, (10M)  
**5183008** SMEC, (6 socket)  
**17460** SpaceLabs (use with SpaceLabs adapters 700-0028-00 & 0120-0551-00 when testing UltraView Command Module), (6 pin)  
**5183020** SpaceLabs/Squibb, Alpha/703R, (5M)  
**17460** SpaceLabs-TK-1, 1050, 1700, PCMS (6M)  
**17460** Tektronix-Squip-TK-1, BP cable (6M)  
**17460** Vitatek/Squibb, (6 pin)

This device is not to replace clinical testing of waveform detecting devices such as patient monitors.

The MPS450 Multiparameter Simulator does not provide simulations for all types of fetal heart rate tracings and contraction patterns, including the following:

- variable decelerations
- sinusoidal pattern
- reactive tracing
- variations in FHR variability
- tachysystole

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**About Fluke Biomedical**

Fluke Biomedical is the world's leading manufacturer of quality biomedical test and simulation products. In addition, Fluke Biomedical provides the latest medical imaging and oncology quality-assurance solutions for regulatory compliance. Highly credentialed and equipped with a NVLAP Lab Code 200566-6 accredited laboratory, Fluke Biomedical also offers the best in quality and customer service for all your equipment calibration needs.

Today, biomedical personnel must meet the increasing regulatory pressures, higher quality standards, and rapid technological growth, while performing their work faster and more efficiently than ever. Fluke Biomedical provides a diverse range of software and hardware tools to meet today's challenges.

**Fluke Biomedical Regulatory Commitment**

As a medical test device manufacturer, we recognize and follow certain quality standards and certifications when developing our products. We are ISO 9001 and ISO 13485 medical device certified and our products are:

- CE Certified, where required
- NIST Traceable and Calibrated
- UL, CSA, ETL Certified, where required
- NRC Compliant, where required

**Fluke Biomedical.**

*Better products. More choices. One company.*

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