

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
- RS232 port for computer control

Optional Features

- Cardiac-output simulation
- Fetal/maternal ECG, direct simulations with intrauterine-pressure waveform
- AC operation

Technical Specifications

Normal-Sinus-Rhythm Waveform

ECG Reference: ECG amplitudes specified for lead II (calibration), from baseline to peak of R-wave; other leads proportional
 Normal Sinus Rhythm: 12-lead configuration with independent outputs referenced to right leg (RL); output to 10 universal ECG jacks, color-coded to AHA and IEC standards
 Low-Level Amplitude: 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)
 Amplitude Accuracy: $\pm 2\%$ of setting lead II
 High-Level Output (Available on BP3 Connector): 0.2 V/mV $\pm 5\%$ of the ECG-amplitude setting
 ECG Rate: 30, 40, 45, 60, 80, 90, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280 and 300 BPM (power-on default: 80 BPM)

(technical specifications continued on next page)

Rate Accuracy: $\pm 1\%$ of setting
ECG-Waveform Selection: Adult (80 ms) or pediatric (40 ms) QRS duration (power-on default: adult QR/P-R interval of 0.16 s)
Superimposed Artifact: 50 Hz and 60 Hz, muscle, baseline wander, respiration
ST-Segment Elevation/Depression: 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)

Pacemaker Waveform

Pacer-Pulse Amplitude: 1 mV, 2 mV, 5 mV, 10 mV, $\pm 10\%$ (power-on default: 5 mV)
Pacer-Pulse Width: 0.1 ms, 0.5 ms, 1 ms, 1.5 ms, 2 ms, $\pm 5\%$ (power-on default: 1 ms)
Pacing Rate: 75 BPM
Waveforms: (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

Arrhythmias

Baseline NSR: 80 BPM
PVC Focus: Left focus, standard timing (except where specified)
Supraventricular Arrhythmias: (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
Premature Arrhythmias (All One-Time Events): (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
Ventricular Arrhythmias: (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
Conduction Defects: (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

ECG-Performance Testing

Amplitude: 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)
Pulse Wave: 30 BPM, 60 BPM, with 60 ms pulse width
Square Wave: 2 Hz, 0.125 Hz (power-on default: 2 Hz)
Triangle Wave: 2 Hz, 2.5 Hz
Sine Wave: 0.5, 5, 10, 40, 50, 60 and 100 Hz
R-Wave-Detection Waveform: Haver-Triangle
R-Wave Rate: 30, 60, 80, 120, 200 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)
Rate Accuracy: $\pm 1\%$
Amplitude Accuracy: $\pm 2\%$, lead II (exception: $\pm 5\%$ for R-waves ≤ 20 ms)

Respiration

Rate: 0 (OFF), 15, 20, 30, 40, 60, 80, 100 and 120 BrPM (power-on default: 20 BrPM)
Impedance Variations ($\Delta\Omega$): 0.2, 0.5, 1, or 3 Ω (power-on default: $\Delta 1 \Omega$)
Accuracy Delta: $\pm 10\%$
Baseline: 500, 1000, 1500, and 2000 Ω , leads I, II, III (power-on default: 1000 Ω)
Accuracy Baseline: $\pm 5\%$
Respiration Lead: LA or LL (power-on default: LA)
Apnea Selection: 12, 22, or 32 s (one-time events), or continuous (apnea ON = respiration OFF; power-on default: 12 s apnea)

Blood Pressure

Input/Output Impedance: 300 $\Omega \pm 10\%$
Exciter-Input Range: 2 V RMS to 16 V RMS
Exciter-Input-Frequency Range: DC to 5000 Hz
Transducer Sensitivity: 5 $\mu\text{V}/\text{V}/\text{mmHg}$ or 40 $\mu\text{V}/\text{V}/\text{mmHg}$ (power-on default: 5 $\mu\text{V}/\text{V}/\text{mmHg}$)
Pressure Accuracy: $\pm (2\% \text{ reading} + 2 \text{ mmHg})$

Static Levels, P1: -10, 0, 80, 160, 240, 320, and 400 mmHg (power-on default: 0 mmHg)

Static Levels, P2: -10, 0, 50, 100, 150, 200, and 240 mmHg (power-on default: 0 mmHg)

Static Levels, P3: -5, 0, 20, 40, 60, 80, and 100 mmHg (power-on default: 0 mmHg)

Static Levels, P4: -5, 0, 20, 40, 60, 80, and 100 mmHg (power-on default: 0 mmHg)

Dynamic Waveforms, P1: Arterial: 120/80, radial artery: 120/80, left ventricle: 120/00, right ventricle: 25/00

Dynamic Waveforms, P2: 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

Dynamic Waveforms, P3: 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

Dynamic Waveforms, P4 (Swan-Ganz sequence): Right atrium (CVP), right ventricle (RV), pulmonary artery (PA), pulmonary-artery wedge (PAW)

Respiration Artifact: BP delta change from 3 mmHg to 16 mmHg
BP Output: Mini DIN 7-pin

Temperature

32 °F (0 °C), 75.2 °F (24 °C), 98.6 °F (37 °C), and 104 °F (40 °C) (power-on default: 32 °F/0 °C)
Accuracy: $\pm 0.1\text{ }^\circ\text{C}$
Compatibility: Yellow Springs, Inc. (YSI) Series 400 and 700
Output: Mini DIN 7-pin

Cardiac Output (Optional)

Catheter Type: Baxter Edwards, 93a-131-7f
Calibration Coefficient: 0.542 (0 °C injectate), 0.595 (24 °C injectate)
Blood Temperature: 37 °C (98.6 °F) $\pm 2\%$
Injectate Volume: 10 cc
Injectate Temperature: 0 °C or 24 °C $\pm 2\%$ value (power-on default: 0 °C injectate)
Cardiac Output: 2.5 lpm, 5 lpm, 10 lpm $\pm 5\%$ (power-on default: 2.5 lpm)
Faulty-Injection Curve: (Waveform for simulation available)
Left-to-Right-Shunt Curve: (Waveform for simulation available)
Calibrated Pulse: 1.5 ° for 1 s (37 ° * 35.5 °) (waveform for simulation available)
Repeatability: $\pm 1\%$

Fetal/Maternal ECG (Optional)

Maternal Heart Rate (Fixed): 80 BPM
Fetal Heart Rate (Selectable): 60, 90, 120, 140, 150, 210 and 240 BPM (power-on default: 120 BPM)
Fetal Heart Rate (IUP): 140 BPM at beginning, then varying with pressure
Intrauterine-Pressure Waveforms: Uniform acceleration (140 BPM to 175 BPM to 140 BPM; rate change lagging IUP contraction by 30 s); uniform deceleration (140 BPM to 100 BPM to 140 BPM; rate change lagging IUP contraction by 30 s) (power-on default); 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);
Wave Duration: 90 s, bell-shaped pressure curve, from 0 mmHg to 90 mmHg and returning to 0 mmHg, ± 4 mmHg (max)
IUP Period: 2 min, 3 min, or 5 min; and manual (power-on default: manual)

Computer Setup

Port: Bidirectional (data communications equipment) RS232
Baud Rate: 9600
Parity: None
Stop Bits: 1
Data Bits: 8

Temperature

Operating: 50 °F to 104 °F (10 °C to 40 °C)
Storage: -13 °F to 122 °F (-25 °C to 50 °C)

Humidity

80 % max relative humidity

General Information

Battery Replacement: Warning for low-battery condition (batteries to be replaced at this time)
Power: Two 9 V alkaline batteries (8 hours min continuous power); optional battery eliminator
Dimensions: 7.5 in L x 6 in W x 2 in H (19 cm L x 15.2 cm W x 5 cm H)
Weight: 1.5 lb (0.7 kg)

Ordering Information

Model

- 2251364:** MPS450 (ECG 12-lead simulation; invasive BP; respiration; temperature; BP in sync with ECG; large, bright 4-line x 20-character display; R-wave-detection test; RS232 port for computer control; soft-key navigation; universal ECG connectors; and flash memory for easy program upgrade)
- 2251373:** MPS450-CO (base model plus cardiac-output simulation)
- 2251399:** MPS450-FET (base model plus direct fetal/maternal ECG simulations with maternal heart rate, selectable fetal heart rate, and dynamic intrauterine pressure waveform [IUP])
- 2251386:** MPS450-CO/FET (base model plus cardiac-output simulation and direct fetal/maternal ECG simulations with maternal heart rate, selectable fetal heart rate, and dynamic intrauterine pressure waveform [IUP])

Standard Accessories MPS450

- 2226608:** Cardiac output box MPS450-FET
- 2243350:** User/service manual

Optional Accessories

- 2248623:** Soft-sided vinyl carrying case
- 2238659:** Serial cable D9M-D9F
- 2184298:** AC battery eliminator

Cardiac Output Adapters

- 2392285:** GE Medical/Marquette cardiac output cable (interface cable for GE Medical/Marquette plus monitors, including in-line switch box to select injectate temperature)
- 2227016:** Gould/Spectramed 1445 injectate temperature adapter (4 pin)
- 2227025:** Gould/Spectramed 1465 injectate temperature adapter (phone jack)
- 2226973:** HP injectate temperature adapter (1/4 in phone plug)
- 2391990:** Universal injectate temperature adapter pigtail (unterminated)
- 2392152:** General purpose connector

Temperature Cables

- 2391678:** Hewlett Packard temperature cable adapter
- 2391976:** Temperature cable 400 series (1/4 in phone plug)
- 2391983:** Temperature cable 700 series (1/4 in phone plug)

Blood Pressure Cables

- 2392031:** Burdick (10 socket)
- 2226935:** Care (5 pin)
- 2226947:** Carometrics (3 pin/3 socket)
- 2226986:** Carometrics (12 pin)
- 2226856:** Criticare (6 pin)
- 2226856:** Critikon (6 pin)
- 2226842:** Datascope (6 socket)
- 2392031:** Datex (10 socket)
- 2226935:** Gould/Statham (5 pin)
- 2226888:** Hewlett Packard (5 socket)
- 2226874:** Hewlett Packard/Merlin (12 pin)
- 2226856:** Invivo Research (6 pin)
- 2226856:** Ivy Biomedical (6 pin)
- 2226842:** Kontron/Roche (6 socket)
- 2392022:** Marquette 7000 (8 pin)
- 2392297:** GE Medical/Marquette Eagle (11 pin)
- 2226839:** Marquette Twin (6 pin)
- 2226856:** Medical Data Electronics (MDE) (6 pin)
- 2226863:** Mennen Medical (6 pin)
- 2392005:** MPS-1 Cable to LH-3 adapter, (6 pin)
- 2226895:** Nihon Khoden (5 pin)
- 2226856:** North American Drager (6 pin)
- 2226947:** Novamatrix (3 pin/3 socket)
- 2226856:** Ohmeda (6 pin)
- 2226856:** Physio Control (6 pin)
- 2226856:** Protocol (6 pin)
- 2392031:** Puritan Bennett (10 socket)
- 2226901:** Siemens (10 pin) (used with Siemens Medical transducer adapter (3368-383-E530U) to run a single invasive BP channel on Siemens Medical SC6000 and SC9000 series Monitors)
- 2226842:** SMEC (6 socket)
- 2226856:** SpaceLabs (6 pin) (used with SpaceLabs adapters 700-0028-00 and 0120-0551-00 when testing UltraView command module)
- 2226912:** SpaceLabs/Squibb (5 pin)
- 2226856:** Tektronix/Squibb (6 pin)
- 2392010:** Universal BP adapter (pigtail/unterminated)
- 2226912:** Vitastat (5 pin)
- 2226856:** Vitatek/Squibb (6 pin)

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.

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

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

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