FLUKE®

Biomedical

BP Pump 2

Non-Invasive Blood Pressure Simulator and Tester

Technical Data

The BP Pump 2 provides dynamic blood-pressure simulations for testing adult and neonatal non-invasive blood pressure monitors, including both arm- and wrist-cuff types.

The analyzer features a preset mode for simulation of most patient conditions and the capability to program user-defined simulations. BP Pump 2 tests for leaks, measures static pressure, generates pressure, and tests overpressure valves. For improved testing versatility, the analyzer's recently upgraded waveform test suite includes additional physiological selections.

BP Pump 2 comes in two models: the standard BP Pump 2_L and the BP Pump 2_M. The BP Pump 2_M features a high-accuracy pressure transducer to meet the EN1060-3 standard used widely in Europe for testing non-invasive blood pressure monitors. It also includes five-lead synchronized ECG simulations to test monitors that use ECG for motion rejection.

Key Features

BP Pump 2_L and BP Pump 2_M

- Dynamic simulations for arm- and wrist-cuff monitors
- Recently upgraded waveform test suite with more physiological selections
- Internal pump for use in high- and low-pressure release verification, leak testing and pressure sourcing
- Preset mode for simulation of most patient conditions
- User-defined autosequences
- Internal cuff volume for basic device testing
- RS232 for computer control
- Compact, lightweight, and user friendly
- Respiratory artifacts, including spontaneous breathing and controlled ventilation
- Arrhythmia simulations, including premature atrial contractions #1 and #2, atrial fibrillation, and PVCs

BP Pump 2_M also includes:

- High-accuracy pressure transducer
- Five-lead synchronized ECG and arrhythmia simulation with blood pressure for both

Technical Specifications

Pressure Generation
Static-Pressure Range: 0 mmHg to 400 mmHg
Difference Between Target Pressure and Actual Pressure: ± 10 mmHg from
100 mmHg to 400 mmHg with minimum volume of 300 cc
Internal Leak Rate: < 2 mmHg per minute with minimum volume of 300 cc

Four Respiratory Artifacts
3 spontaneous breathing; controlled ventilation

3 Adult Wrist-Cuff Simulations
Normal, Hyper, Hypo

Pressure Source
Specified pressure generated from 0 mmHg to 400 mmHg in selectable increments of 1 mmHg

Pressure Gauge
Static pressure measured from 0 mmHg to 400 mmHg at the pressure port

Pressure Relief Rest
Test for the NIBPM pressure relief valve (0 mmHg to 400 mmHg) with display of peak pressure

Neonate Internal Cuff Simulations
Internal neonate cuff; four standard neonate pressures

Neonate Simulations
Cuff #1: Blood pressure: 35/15; heart rate: 120 BPM; pulse volume: 0.3
Cuff #2: Blood Pressure, 60/30; heart rate: 120 BPM; pulse volume: 0.3
Cuff #3: Blood pressure, 80/50; heart rate: 120 BPM; pulse volume: 0.3
Cuff #4: Blood pressure, 100/70; heart rate: 120 BPM; pulse volume: 0.3

Normal Sinus Rhythm
BP and ECG: Healthy heart, weak pulse, mild exercise strenuous exercise, obese subject, geriatric subject, tachycardia, bradycardia irregular pulse
BP and ECG: Premature atrial contractions # 1, premature atrial contractions # 2, premature ventricular contractions, atrial fibrillation and PVCs

User-Definable Simulations
User-definable systolic and diastolic values, along with heart rate and pulse volume

Ranges
Systolic Pressure Range: 20 mmHG to 250 mmHG
Diastolic Pressure Range: 10 mmHG to 200 mmHG
Heart Rate: 30 BPM to 250 BPM
Pulse Volume: 0.1 cc to 2.4 cc in increments of 0.1 cc

Simulation Parameters Performance
Max Pulse Volume: 2.4 cc
Max Heart Rate: 200 BPM at 2.4 cc pulse volume; 250 BPM at 1.2 cc pulse volume
Internal Neonatal Cuff Volume: 20 cc
Internal Adult Cuff Volume (Including NN Volume): 310 cc
Heart Rate Setting Accuracy: ± 1 BPM
Simulation Units: kPa and mmHg (user selectable)

Pressure Leak Test
The pressure port is pressurized from 0 mmHg to 400 mmHg and keeps track of the pressure loss over time. Peak pressure and present pressure are displayed at all times; leak rate is displayed when it is available.

Autosequences
Nine autosequences are provided for four tests and up to five simulations.

Electrical ECG
Signals: RA, LA, RL, LL, V
Waveform: Lead II
Amplitude: 1 mV peak (± 10 %)
Connections: Optional external ECG adapter physiological synchronization with NIBP

Heart Rate for NIBP Simulations
Heart Rate Accuracy: + 1 BPM
Except for the Following:
- Patient condition weak pulse, tachycardia, obese, geriatric: + 1 % + 1 BPM
- Patient condition mild exercise: + 1.5 % + 1 BPM
- Patient condition strenuous exercise:+ 3 % + 1 BPM

Serial Port
Bidirectional RS232 port; baud rate of 9600 with no parity, one stop bit, and eight data bits

Pressure Measurement
Pressure-Measurement Units: kPa, mmHg, cmH_20, cmH_20 and psi (user selectable)
Range: 0 mmHg to + 400 mmHg
Resolution, BP Pump 2L (Basic Model): 0.1 kPa, 1 mmHg, 1 cmH_20, and 0.1 psi
Resolution, BP Pump 2M (High-Accuracy Version): 0.01 kPA, 0.1 mmHg, 0.1 cmH_20, 0.1 in H_20, 0.01 psi

Accuracy
- Basic Model (BP Pump 2L): 0 mmHg to 300 mmHg: + 0.5 % of reading + 1 mmHg; 301 mmHg to 400 mmHg: + 2 % of reading
- High-Accuracy Version (BP Pump 2M): < 0.8 mmHg (0.1 kPa) throughout range

Parallel Port
25-pin female connector, with D-subminiature style and pinouts conforming to IBM PC printer port (unidirectional), HP and ASCII printers

Sample Adult Arm-Cuff Simulation
Parameters (Standard)
Standard Set of Blood Pressures
BP #1: Blood pressure: 120/80 (93); heart rate: 80; pulse volume: 0.68 cc
BP #2: Blood pressure: 150/100 (116); heart rate: 80; pulse volume: 0.65 cc
BP #3: Blood pressure: 200/150 (166); heart rate: 80; pulse volume: 0.6 cc
BP #4: Blood pressure: 255/195 (215); heart rate: 80; pulse volume: 0.55 cc
BP #5: Blood pressure: 60/30 (40); heart rate: 80; pulse volume: 0.75 cc
BP #6: Blood pressure: 80/50 (60); heart rate: 80; pulse volume: 0.7 cc
BP #7: Blood Pressure: 100/65 (76); heart rate: 80; pulse volume: 0.69 cc

Patient Condition Simulations
Healthy Heart: Blood pressure: 120/80 mmHg (93 MAP); heart rate: 75 BPM; pulse volume: 0.7 cc
Weak Pulse: Blood pressure: 110/80 (90); heart rate: 95 BPM; pulse volume: 0.3 cc
Mild Exercise #1: Blood pressure: 140/90 (106); heart rate: 120 BPM; pulse volume: 1.1 cc
Strenuous Exercise #2: Blood pressure: 140/90 (106); heart rate: 162 BPM; pulse volume: 1.4
Obese Subject: Blood pressure: 120/80 (93); heart rate: 90 BPM; pulse volume: 0.4 cc
Geriatric Subject: Blood pressure: 150/110 (12); heart rate: 95 BPM; pulse volume: 0.4 cc
Tachycardia: Blood pressure: 120/105 (110); heart rate: 130 BPM pulse volume: 0.3 cc
Bradycardia: Blood pressure: 120/60; heart rate: 45 BPM; pulse volume:1.1 cc

Arrhythmia Simulations
Premature Atrial Cont. #1: Blood pressure: 138/53 mmHg (81 MAP); heart rate: 80 BPM; pulse volume: varies
Premature Atrial Cont. #2: Blood pressure: 144/64 (90); heart rate: 83 BPM; pulse volume: varies
Premature Ventricular Cont.: Blood pressure: 118/61 (80); heart rate: 83 BPM; pulse volume: varies
Atrial Fib and PVCs: Blood pressure: 139/72 (94); heart rate: 91 BPM; pulse volume: varies

Respiratory Artifacts
Spontaneous Breathing #1: Blood pressure: 138/65 mmHg (89 MAP); heart rate: 104 BPM; pulse volume: varies
Spontaneous Breathing #2: Blood pressure 149/65 (93); heart rate: 105 BPM; pulse volume: varies
Spontaneous Breathing #3: Blood pressure: 112/47 (68); heart rate: 86 BPM; pulse volume: varies

Controlled Ventilation
Blood Pressure: 132/44 (73); heart rate: 98 BPM; pulse volume: varies

Wrist Simulations
Simulation #1: Blood pressure 120/80 (93); heart rate: 80 BPM; pulse volume: 0.5 cc
Simulation #2: Blood pressure 160/100 (120); heart rate: 80 BPM; pulse volume: 0.5 cc

Simulation #3: Blood pressure: 80/55 (63); heart rate: 80 BPM; pulse volume: 0.5 cc

Temperature
Operating: 15 ˚C to 40 ˚C
Storage: -20 ˚C to 65 ˚C

Relative Humidity
90 ˚ max

Display
Bright, large 4-line x 40-character alphanumeric display with back lighting

Dimensions
10 in L x 10 in W x 5 in H
(25.4 cm x 25.4 cm x 12.7 cm)

Weight
7.5 lb (3.4 kg)

Ordering Information

Model
BP Pump 2_L (standard pressure transducer)
2249036: BPPUMP2L-US120V
2394895: BPPUMP2L-AUS250V
2394901: BPPUMP2L-DEN250V
2394912: BPPUMP2L-SHK250v
2394920: BPPUMP2L-ISR250V
2394935: BPPUMP2L-ITAL250V
2394947: BPPUMP2L-IND250V
2394958: BPPUMP2L-SWZ250V
2394964: BPPUMP2L-UK250V

BP Pump 2_M (high-accuracy pressure transducer)
2249049: BPPUMP2M-US120V
2394973: BPPUMP2M-AUS250V
2394986: BPPUMP2M-DEN250V
2394999: BPPUMP2M-SHK0250V
2395003: BPPUMP2M-ISR250V
2395015: BPPUMP2M-ITAL250V
2395026: BPPUMP2M-IND250V
2395032: BPPUMP2M-SWZ250V
2395044: BPPUMP2M-UK250V

Standard Accessories
2391882: Accessory kit (tubings and fittings)
N/A User/service manual
N/A Power cord (country specific)

Optional Accessories
2222822: Soft-sided vinyl carrying case
2391894: ECG adapter block (allows simulation of 5-lead ECG waveforms)
2238072: Parallel printer cable, D25M-C36M
2248899: Printer, Seiko DPU-414-30B, 120 V power supply
2399531: Printer, Seiko DPU-414-30B, 200 V power supply
2235375: Printer, 120 V power supply
2235382: Printer, 220 V power supply
2248737: Printer paper (7 rolls min)
2238659: Serial cable, D9M-D9F
2392381: Adult cuff mandrel spacer block (three required)
2392370: Adult cuff mandrel end block (two required)
2392328: Neonatal/external cuff mandrel (truncated plastic cylinder diameters: 7.6, 10, and 14 cm)
2391875: Wrist cuff mandrel (adult)

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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