



DATREND  
Systems Inc.

# MPS-2

*Patient Simulator*

Operating Manual



# MPS-2

## *Patient Simulator*

### Operating Manual

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- Use of an AC power supply adapter other than the AC adapter specified for the instrument;
- Power failure, surges, or spikes;
- Damage in transit or when moving the instrument;
- Improper power supply such as low voltage, incorrect voltage, defective wiring or inadequate fuses;
- Accident, alteration, abuse or misuse of the instrument;
- Fire, water damage, theft, war, riot, hostility, acts of God, such as hurricanes, floods, etc.

Only serialized products (those items bearing a distinct serial number tag) and their accessory items are covered under this warranty. **PHYSICAL DAMAGE CAUSED BY MISUSE OR PHYSICAL ABUSE IS NOT COVERED UNDER THE WARRANTY.** Items such as cables and non-serialized modules are not covered under this warranty.

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When you return an instrument to DSI for service, repair or calibration, we recommend shipment using the original shipping foam and container. If the original packing materials are not available, we recommend the following guide for repackaging:

- Use a double-walled carton of sufficient strength for the weight being shipped.
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- Use at least four inches of tightly packed, industrial-approved, shock-absorbent material all around the instrument.

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**Warranty Disclaimer**

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## Abbreviations, Definitions and Symbols




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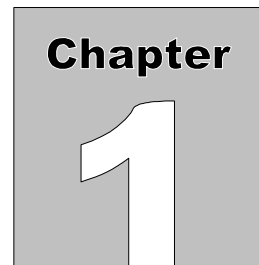
The following abbreviations, terms and acronyms are used throughout this manual:

°C	degrees Celsius (centigrade)
°F	degrees Fahrenheit
AED	Automated External Defibrillator
AHA	American Heart Association
Arrhythmia	An abnormal rhythm of the cardiac muscle; an abnormal pattern or rate of heart beats.
Autosequence	A series of measurements or test operations that are run automatically in a predefined order, with or without user involvement.
BP	Blood Pressure
BPM	(ECG) Beats Per Minute or (RESPIRATION) Breaths Per Minute
cc	cubic centimeters
cm	centimeter
CO	Cardiac Output
DUT	Device Under Test
ECG	Electrocardiogram. Equivalent to EKG.
Hg	Mercury
HORIZ	Horizontal
Hz	Hertz
IEC	International Electrotechnical Commission
INT	Intermediate
k	kilo
kg	kilogram
kHz	kilohertz
kV	kilovolt
kΩ	kilo-ohm
l/min	liters per minute
LA	Left arm ECG connection or electrode
LL	Left leg ECG connection or electrode
LV	Left Ventricular
μ	micro
μV/V/mmHg	microvolt per volt per millimeter of Mercury
MHz	megahertz
m	milli-
mA	milliampere
mm	millimeter
mmHg	millimeters of Mercury
mS	milliseconds
msec	milliseconds
mV	millivolt
NSR	Normal Sinus Rhythm
Ω	ohm

**MPS-2 OPERATING MANUAL**

Pacer	A transvenous or implanted pacemaker
PAC	Premature Atrial Contraction
PNC	Premature Nodal Contraction
PVC	Premature Ventricular Contraction
QRS complex	A specific segment of the electrocardiogram signal, comprising the Q, R and S waves, which corresponds to the heart systole.
RA	Right arm ECG connection or electrode
RL	Right leg ECG connection or electrode
RV	Right Ventricular
TEMP	Temperature
V	volt
V1-V6	Chest electrodes 1 through 6 of the ECG
VERT	Vertical
W	watt

Style Example	Definition
	Activates or Enables a Setting, Parameter or Feature.
	Scrolls Menu Left or Right (as available - indicated by ◀ and ▶ on the LCD Display)
	Increases or Decreases the value of a setting (as available - indicated by ▲ and ▼ on the LCD Display)



# 1 Specifications

## 1.1 General Specifications

### Environment:

- 15°C to 40°C (59°F to 104°F)
- 10% to 90% Relative Humidity
- Indoor Use Only

### Power Supply:

- 9V Alkaline battery, or
- Optional Battery Eliminator, 9 VDC / 500 mA (region specific, as noted in Appendix B)

### Electrical Interfaces:

- 10 standard ECG snap leads
- 10 ECG jacks (accepts 3 mm or 4 mm plugs)
- BP 1/2: proprietary USB
- TEMP: 6-pin mini-DIN
- High-level ECG Out: 2.5mm stereo phono jack
- DC IN: EIAJ-3, center-positive (9 VDC, 500 mA)
- RS-232 Serial Port: proprietary RJ-12

### User Interface:

MPS-2 is controlled through 10 keys on the front panel keypad, allowing the user to easily access all functions of the simulator.

As individual functions are activated, they remain active unless turned off, allowing numerous simulations to be enabled concurrently, with all appropriate signals synchronized.

## MPS-2 OPERATING MANUAL

### Display:

20 character by 8 line alphanumeric/128 x 64 graphic LCD

### Dimensions and Weight:

- 9.2cm x 14.5cm x 3.3 cm (3.6" x 5.6" x 1.3")
- 0.33 kg (11.5 oz)

## 1.2 Simulation Specifications

### ECG General:

- Simulation Type: Full 12-Lead ECG with independent outputs for each signal lead, referenced to RL
- Output Impedance: 500, 1000, 1500, and 2000 ohms to RL
- High Level Output: Lead II amplitude x 500 (0.5V per Lead II millivolt)
- Amplitude Accuracy:  $\pm 2\%$  (Lead II, 2 Hz Square Wave)

### Normal Sinus Rhythm:

- Rates: 30, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, and 300 BPM
- Rate Accuracy:  $\pm 1$ BPM
- Amplitudes (Lead II): 0.25, 0.5, 1, 2, 3, 4 and 5 mV - normal amplitude settings
  - ST Segments: -0.1, -0.2, -0.3, -0.4, -0.5, -0.6, -0.7, -0.8, 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7 and 0.8 mV
- Neonatal Mode: ECG R-wave width is reduced to 40 milliseconds

## MPS-2 OPERATING MANUAL

**Arrhythmia:** ( \* indicates a one-time event, which is activated each time the ENTER key is pressed )

### GENERAL 1

- Asystole 1
- Bigeminy 1, PVC 1
- Bigeminy 2, PVC 2
- Trigeminy 1, PVC 1
- Trigeminy 2, PVC 2
- PAC
- PNC
- Multifocal PVC
- Frequent Multifocal PVC

### PVC 1

- LVF \*
- EARLY LVF \*
- R on T LVF \*
- PVC 6/Minute
- PVC 12/Minute
- PVC 24/Minute
- PVC Pair \*
- Run 5 \*
- Run 11 \*

### PVC 2

- RVF \*
- EARLY RVF \*
- R on T RVF \*
- PVC 6/Minute
- PVC 12/Minute
- PVC 24/Minute
- PVC Pair
- Run 5 \*
- Run 11 \*

### BLOCK

- First Degree
- Second Degree TYPE 1
- Third Degree
- Right Bundle Branch Block
- Left Bundle Branch Block

### FIBRILLATION

- Atrial Fibrillation, Coarse
- Atrial Fibrillation, Fine
- Ventricular Fibrillation, Coarse
- Ventricular Fibrillation, Fine

### TACHYCARDIA

- Paroxysmal Atrial Tachycardia
- Supraventricular Tachycardia
- Ventricular Tachycardia

### GENERAL 2

- Atrial Flutter
- Sinus Arrhythmia
- Missed Beat \*
- Missed Beat @ 80 BPM
- Missed Beat @ 120 BPM
- Nodal

## MPS-2 OPERATING MANUAL

### ECG Performance Tests:

- Square Waves: 2 Hz, 0.125 Hz
- Triangle Wave: 2 Hz
  - Pulse: 80 msec, 1 Hz (60 BPM)
- Sine Waves: 0.5, 1, 10, 40, 50, 60, and 100 Hz

### Respiration:

- Rates: 0, 15, 20, 30, 40, 60, 80, 100 and 120 BPM
- Baseline Impedance: 500, 1000, 1500, 2000 ohms on Leads I, II, III
  - Apnea Selections: 12, 22, 32 seconds, and continuous
- Impedance Variation: 0, 0.2, 0.5, 1, 2, 3 ohms

### Temperature:

- Channels: 2
- Body Temperatures: 30, 35, 37, 38, and 40°C
- Probe Compatibility: YSI series 400 or 700

### Pacemaker:

- Simulated Rhythms:
  - Asynchronous @ 75 BPM
  - Demand with frequent sinus beat
  - Demand with occasional sinus beat
  - A-V sequential
  - Non-capture
  - Non-function
- Pacer Pulse Amplitude: 2, 4, 8, 10, 12, 14, 16, 18, 20, 50, 100 mV
  - Pacer Pulse Width: 0.1, 0.2, 0.5, 1.0, and 2.0 msec
  - Pacer Pulse Polarity: Positive or negative



## MPS-2 OPERATING MANUAL

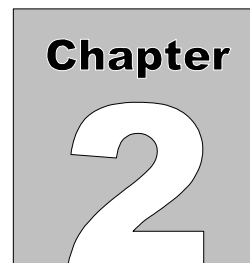
### Invasive Blood Pressure:

- Channels: 2 functionally identical channels
- Static Pressures: -10, -5, 0, 20, 40, 60, 80, 100, 120, 150, 160, 180, 200, 240, 320 and 400 mmHg
- Transducer Sensitivity: 5  $\mu\text{V}/\text{V}/\text{mmHg}$  or 40  $\mu\text{V}/\text{V}/\text{mmHg}$
- Dynamic Simulations:
  - Arterial 120/80
  - Left Ventricular 120/0
  - Right Ventricular 25/0
  - Left Atrium 14/4
  - Right Atrium 15/10
  - Pulmonary Artery 25/10
  - Pulmonary Wedge 10/2
- Swan-Ganz Simulations: Auto or Manual
  - Respiration Artifact: OFF; 5 mmHg; or 10 mmHg

### Auto Presets:

Ten user-defined simulation setups can be programmed and uploaded to MPS-2 using PC based software (Hyperterminal, or equivalent).





## 2 General Information

### 2.1 Overview

The MPS-2 Patient Simulator is a simulation platform designed to expedite and simplify the testing of many patient monitoring devices.

The wide range of simulations available for ECG, artifacts, arrhythmia conditions, performance tests, respiration, pacemaker, body temperature, and invasive blood pressure make MPS-2 suitable for testing most of the basic functions of many patient simulators. If advanced features such as Cardiac Output or additional pressure channels are needed, the AMPS-1 Advanced Modular Patient Simulator should be considered.

### 2.2 Features

The compact and portable MPS-2 measures just 9.2cm x 14.5cm x 3.3 cm (3.6" x 5.6" x 1.3"), weighs less than 330 grams (11.5 ounces), and operates for approximately 20 hours continuous use when powered by a single 9 Volt alkaline battery.

MPS-2 is controlled through 10 keys on the front panel keypad, allowing the user to easily access all functions of the simulator. As individual functions are activated, they remain active unless turned off, allowing numerous simulations to be enabled concurrently, with all appropriate signals synchronized.

MPS-2 includes an RS-232 communication port to allow control through serial commands. This allows MPS-2 to be integrated with Datrend's ES601 Plus Automated Safety Analyzer, and to communicate with a personal computer (PC), allowing the user to create Auto Settings (i.e. combinations of simulator settings) using suitable terminal emulation software applications such as Hyperterminal, or equivalent.

## 2.3 Main Functions of MPS-2

- ECG Normal Sinus Rhythm
- Arrhythmia Waveforms, including premature beats; conduction defects; supraventricular beats; ventricular rhythm and tachycardia; fibrillation; etc.
- ECG Performance Waveforms
- Pacemaker Waveforms
- Temperature
- Respiration Waveforms
- Invasive Blood Pressure (static and dynamic, including Swan-Ganz)

Details and specifications of each function are described in the chapters to follow.

## 2.4 Powering up MPS-2

To power up, press the POWER button on the right side of MPS-2.

The Power-On screen, which shows the firmware version number, will appear briefly and then be replaced by the Main Menu screen, **Figure 1**.



**Figure 1:** Power On Screen

ECG, respiration, temperature, and other simulation parameters are automatically initialized to default values when MPS-2 is powered up. These settings are the "Power-On" defaults for MPS-2. As described in section 2.6, up to ten MPS-2 parameters can be programmed by the user to configure the default patient simulation which takes effect at power-on.

Selection of the operating Functions in MPS-2 is accomplished through a menu list which consists of four lines with three function selections on each line. One of the four menu lines will be displayed on the bottom line of the LCD screen. Each function selection is placed above an unlabeled 'soft-key' which, when pressed, will select the Function above it (eg. RESP, PACER, TEMP).

## MPS-2 OPERATING MANUAL

The four lines of the Menu are:

ECG	ARR	PERF
RESP	PACER	TEMP
BP1	BP2	VIEW
AUTO	SAVE	SETUP

Pressing the Menu key will scroll through the Menu lines repeatedly until a Function is selected with a 'soft-key'. Pressing Menu will also return to the Menu screen above, from within any other screen.

### **2.5 MENU and NUMERIC Modes**

At power-on, MPS-2 operates in a menu mode. In this mode, a three function menu line appears at the bottom of the screen (eg. ECG, ARR, PERF). There are four menu lines available which can be accessed by pressing the MENU key. The three un-named keys below the screen are 'soft-keys' which will activate the functional menu of the function above it on the menu. Each 'soft-key' button (ECG; ARR; PERF; and so on) enters a menu corresponding to the label on the button face. The scroll keys (◀; ▶; ▲; ▼) are then used to navigate the selected menu. When a desired setting is shown on the LCD display, the ENTER button is pressed to activate the setting.

A NUMERIC mode is available through the RS-232 port. In NUMERIC mode, code numbers can be input via the RS-232 port which will then activate corresponding simulation functions or settings. Code numbers used in NUMERIC mode are listed in Appendix A of this manual.

### **2.6 Power-On Defaults**

A wide range of simulation parameters are automatically initialized to default values when MPS-2 is powered up. These settings are the "Power-On" defaults for MPS-2.

Immediately after applying power to MPS-2, pressing the VIEW button, then ENTER button repeatedly will scroll through the current settings for the "Power-On" defaults, as shown in **Figure 2** through **Figure 7** inclusive.

## MPS-2 OPERATING MANUAL

Typical VIEW screens are shown below:

```
ECG: NSR 80 BPM
AMPL: 1mV
QRS: ADULT
ARTIFACT: OFF
BASELINE: 10000
-----
VIEW SETTINGS
VIEW CURRENT SETTINGS
```

Figure 2: MPS-2 ECG VIEW Screen

```
BP1: 0 mmHg
BP2: 0 mmHg
BP SENSITIVITY= 5µV
BP ARTIFACT: OFF
-----
VIEW SETTINGS
VIEW CURRENT SETTINGS
```

Figure 3: MPS-2 BP VIEW Screen

```
RESP RATE: 20 BR/M
DELTA: 10
LEAD: LI (LA)
BASELINE: 10000
-----
VIEW SETTINGS
VIEW CURRENT SETTINGS
```

Figure 4: MPS-2 RESPIRATION VIEW Screen

```
PACE AMPL: 20mV
POLARITY: LII=+
DURATION: 2mS
-----
VIEW SETTINGS
VIEW CURRENT SETTINGS
```

Figure 5: MPS-2 PACER VIEW Screen

```
TEMPERATURE: 37°C
-----
VIEW SETTINGS
VIEW CURRENT SETTINGS
```

Figure 6: MPS-2 TEMPERATURE VIEW Screen

```
BATTERY >9V OK
REVISION= 1.06
-----
VIEW SETTINGS
VIEW CURRENT SETTINGS
```

Figure 7: MPS-2 GENERAL VIEW Screen



At power-up, MPS-2 initially sets all blood pressure (BP) channels to **zero pressure**, regardless of which dynamic BP waveforms may have been set as the power-on defaults. This allows the pressure channels of the monitor under test to be zeroed. After calibrating the zero pressure level on each BP channel of the patient monitor, you can then activate the dynamic BP simulations by selecting the dynamic waveform on the MPS-2 keypad.

There are two methods to change power-on default settings: via menu mode and via the RS-232 port.

## MPS-2 OPERATING MANUAL

### 2.6.1 Menu Mode

Press the desired menu keypad button to open the corresponding functional menu.

Using the Arrow buttons (◀; ▶; ▲; ▼) to select any of following simulator parameters listed in the table below. After making a selection, press the ENTER button to enable the change.

Menu button	Parameters which can be set as power-on defaults
ECG	RATE, AMPLITUDE, BASELINE (impedance)
RESP	RATE, IMPEDANCE, DELTA, RATIO
PACER	AMPL, WIDTH, POS/NEG (positive/negative)
TEMP	TEMPERATURE

Continue until the above parameters are configured to your preferences. Remember to press ENTER after making each selection to enable the change.

When you are finished changing the settings, press the 'soft-key' SAVE selection to store the settings as the power-on defaults in MPS-2 memory.

### 2.6.2 Numeric Mode

After powering up MPS-2 connect the simulator to an RS-232 port on a PC. If your PC does not have a serial port a suitable USB - RS-232 adapter may be required. Contact Datrend if one is not available locally.

Referring to the table in the preceding section, and to the numeric codes listed in Appendix A, find the numeric code for the setting you wish to apply as a power-on default. Input the appropriate code following the instructions for RS-232 control in Chapter 13. To change another power-on setting in NUMERIC mode, repeat these steps.

When you are finished changing settings or selections, select the SAVE function from the Menu.

## 2.7 Connecting to MPS-2

As shown in **Figure 8**, the lower half of the enclosure, on the left and right sides and the bottom edge of MPS-2 features a full set of universal ECG snaps and jacks, enabling connection of any 3, 5, or 10-lead ECG device. AHA and IEC colour-coded rings surrounding each post and jack aid in connection of corresponding U.S. or international patient leads to the proper ECG signals. Alternating snaps and jacks make connecting easy and conveniently keep leads out of the way. The ECG jacks accommodate standard 3 mm or 4 mm plugs.

The left side on the upper half of the enclosure of MPS-2 provides connections for Temperature, 2 Invasive Blood Pressures and a stereo phono jack provides a high-level ECG output on the tip connection.



**Figure 8:** MPS-2 Interface

A wide array of Invasive BP and temperature cables are available and are listed in Appendix B of this manual.

The right side on the upper half of the enclosure of MPS-2 provides interfaces for DC adapter plug, Power On/Off button and RS-232 communication port.

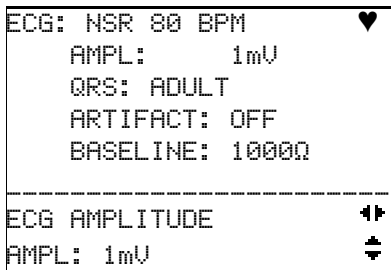
## 2.8 Navigating MPS-2 Menus

The menus of MPS-2 have been arranged to minimize, as much as possible, the keystrokes needed to select a particular setting.

The three blank keys below the display screen are associated with a high level function. The functions are provided in four lines with three functions per line. For example, ECG, ARR, PERF are on line one, and so on. The key labeled **Menu** will scroll through the four menu lines. At any time, pressing **Menu** will either cycle through the menu lines, or return to the Menu if you are in some other function. Each time a function key is pressed, you are taken to a menu which allows you to change the simulation settings for that function.



In **Figure 9** below, ECG has been selected. The screen now displays the status of most of the ECG parameters, along with the standard functional selection menu on the bottom two lines of the screen.



**Figure 9:** MPS-2 ECG Initial Selection Screen

The upper of these two lines of the LCD screen will show a *parameter* for the selected function. For example, parameters associated with the ECG function are: Rate, Amplitude, Baseline and Artifact. LEFT (◀) and RIGHT (▶) arrow keys in the lower center of the MPS-2 keypad, under the LCD, allow you to scroll through the available parameters. UP (▲) and DOWN (▼) arrow keys, on the lower of the two functional menu lines, are used to modify the *setting* for the displayed parameter. Settings may be numeric (e.g., AMPL: 0.5mV), descriptive (e.g., ARTIFACT: MUSCLE), or a toggle (e.g., NEONATAL: ON [OFF]). After a selection is made, ENTER is pressed to activate the selection. When in this mode, no change will be made to the *parameter*, or *setting* unless the ENTER key is pressed.



After selecting any simulator setting, the setting *will not take effect until* the ENTER key is pressed. This prevents inadvertent changes of waveform during the menu-scrolling process.

In addition to the MENU button on the MPS-2 keypad, there is an AMPLITUDE button. At any time, the amplitude of the ECG/PERFORMANCE waveform can be advanced to the next setting.



## 3 ECG Normal Sinus Rhythm

### 3.1 Overview

An electrocardiogram (ECG or EKG) is a recording of the electrical activity of the muscles of the heart. Electrical impulses cause the heart muscle to pump. These impulses pass through the body and can be measured at electrodes (electrical contacts) attached to the skin. Up to 10 electrodes may be placed at standard locations on the body, providing information from different directions or orientation with respect to the heart's 'standard' position. An ECG monitor displays the voltage between pairs of these electrodes (and the muscle activity they represent). This display indicates the overall rhythm of the heart, and weaknesses in different parts of the heart muscle.

MPS-2 simulates normal and irregular heartbeats with adjustable settings for heart rate, amplitude, and ST Segment elevation/depression.

### 3.2 Normal Sinus Rhythm

In a normal heart rhythm, the sinus (SA) node generates an electrical impulse which travels through the right and left atrial muscles producing electrical changes which are represented on the electrocardiogram (ECG) by the P wave. The electrical impulse then continues to travel through specialized tissue known as the atrioventricular (AV) node, which conducts electricity at a slower pace. This creates a pause (PR interval) before the ventricles are stimulated. This pause is helpful since it allows blood to be emptied into the ventricles from the atriums prior to ventricular contraction to propel blood out into the body. The ventricular contraction is represented electrically on the ECG by the QRS complex of waves as depicted in **Figure 10**. This is followed by the T wave which represents the electrical changes in the ventricles as they are relaxing. The cardiac cycle, after a short pause, repeats itself.

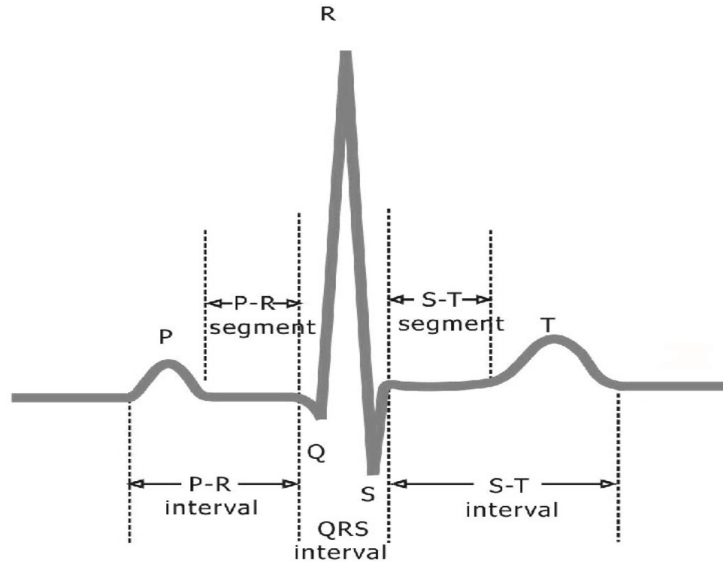


Figure 10 : QRS Complex

### 3.3 Available Settings

Press ENTER after selecting a parameter to activate that setting.

#### 3.3.1 Rates

- 30, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280 and 300 BPM

#### 3.3.2 Amplitudes (Lead II)

- 0.25, 0.5, 1, 2, and 3 mV - using normal settings

#### 3.3.3 Baseline (Electrode) Impedance

- 500, 1000, 1500 and 2000Ω.

#### 3.3.4 Artifact selections

- 50Hz, 60Hz, Muscle, Wandering and OFF. "Wandering" artifact uses the respiration simulation settings for rate and waveshape.

#### 3.3.5 ST Segments (Lead II)

- 0 mV (normal)
- Elevated, +0.1 to +0.8mV in +0.1 mV steps
- Depressed, -0.1 to -0.8mV in -0.1 mV steps

#### 3.3.6 Neonatal Mode

- ECG R-wave width is reduced to 40 msec

### 3.4 ECG Function

Parameters provided for the ECG function are: Rate; Amplitude; Baseline; and Artifact.

Press the Menu key, until the ECG, ARR, PERF line is displayed on the bottom line of the screen. Press the 'soft-key' below the ECG menu label to change the LCD display to that of **Figure 11**, the ECG Rate Menu.

```

ECG: NSR 80 BPM
  AMPL: 1mV
  QRS: ADULT
  ARTIFACT: OFF
  BASELINE: 10000
-----
ECG RATE
RATE: 80 BPM

```

**Figure 11:** MPS-2 ECG Rate Menu

Press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided for the ECG rate: 30, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280 and 300 BPM.

Press the ENTER button to activate the desired rate. The change in rate can be observed via the small flashing heart symbol in the upper right corner of the LCD screen, or through an ECG monitor if such a monitor is connected.

While viewing the display of **Figure 11**, pressing the RIGHT (▶) arrow button once will change the display to that of **Figure 12**, the ECG Amplitude Menu.

```

ECG: NSR 80 BPM
  AMPL: 1mV
  QRS: ADULT
  ARTIFACT: OFF
  BASELINE: 10000
-----
ECG AMPLITUDE
AMPL: 1mV

```

**Figure 12:** MPS-2 ECG Amplitude Menu

Press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided for the ECG amplitude: 0.25, 0.5, 1, 2 and 3mV. This amplitude setting will remain in effect in the ECG setting until another AMPLitude is selected.

## MPS-2 OPERATING MANUAL

Press the ENTER button to activate the desired amplitude. The ECG monitor should show an immediate change in signal amplitude.

Pressing the RIGHT (▶) arrow button will change the screen to that of **Figure 13**, the Baseline Impedance Menu.

```
ECG: NSR 80 BPM
      AMPL: 1mV
      QRS: ADULT
      ARTIFACT: OFF
      BASELINE: 1000Ω
-----
ECG BASELINE
IMPEDANCE: 1000ohm
```

**Figure 13:** MPS-2 ECG Baseline Impedance Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the baseline impedance: 500, 1000, 1500 and 2000Ω. These settings simulate the impedance of the contact between the ECG electrodes and the patient's skin.

Pressing the RIGHT (▶) arrow button will change the screen to **Figure 14**, the ECG Artifact Menu.

```
ECG: NSR 80 BPM
      AMPL: 1mV
      QRS: ADULT
      ARTIFACT: OFF
      BASELINE: 1000Ω
-----
ECG ARTIFACT
ARTIFACT: OFF
```

**Figure 14:** MPS-2 ECG Artifact Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the ECG artifact simulations: 60Hz, 50Hz, MUSCLE, and WANDERING. "Wandering" artifact uses the respiration simulation settings for rate and waveshape. The artifact simulation may be disabled by setting it to OFF (default).

Pressing the RIGHT (▶) arrow button again will restore the LCD display to the ST Segment menu screen of **Figure 15**.

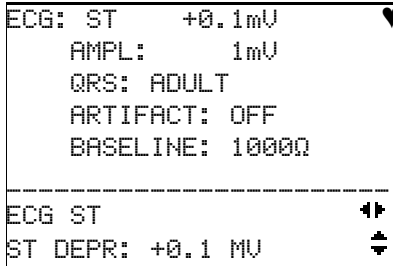


Figure 15: MPS-2 ECG ST Segment Menu

While viewing the ECG ST menu, press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided for ST elevation or depression: 0, +0.1, +0.2, +0.3, +0.4, +0.5, +0.6, +0.7, +0.8, -0.8, -0.7, -0.6, -0.5, -0.4, -0.3, -0.2 and -0.1mV.



If an ST elevation or depression is selected on the menu of **Figure 15**, pressing ENTER overrides the current ECG RATE setting and automatically changes the rate to 80 BPM. This rate override occurs even if ECG ST is set to 0 mV. To restore the original rate, press the ECG button to view the rate, then press ENTER. This will cancel the simulation of ST elevation or depression and return the ECG to NSR.

Pressing the RIGHT (▶) arrow button will change the LCD display to the ECG ADULT/NEONATAL menu screen of **Figure 16**.

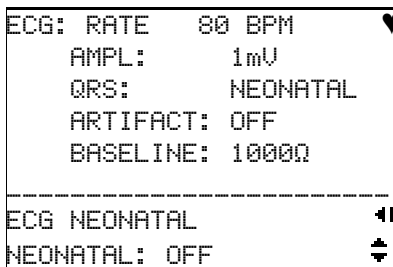


Figure 16: MPS-2 ECG Neonatal Menu

Press the UP (▲) arrow button will scroll through the NEONATAL OFF/ ON selections.

Press the LEFT (◀) arrow button to scroll the display through the above simulator parameters in reverse order.

Press ENTER after selecting a parameter to activate your selection.

## **MPS-2 OPERATING MANUAL**

In some setting lists for parameters in the ECG and other functions, there may be an UP and/or DOWN selection available. When UP is displayed, each press of the ENTER key will increase the parameter setting by one (eg. ECG RATE 80 -> 100). Alternately, when DOWN is displayed, pressing the ENTER key will decrease the parameter setting by one (eg. ECG RATE 180 -> 160).

The UP/DOWN selection is useful if you wish to quickly scroll through all of the available selections, one after the other.



## 4 Arrhythmias

### 4.1 Overview

The term "arrhythmia" refers to any change from the normal sequence of electrical impulses of the heart, resulting in abnormal heart contractions. Arrhythmias can cause the heart to pump less effectively. Some arrhythmias are so brief (for example, a temporary pause or premature beat) that the overall heart rate or rhythm isn't greatly affected. But if arrhythmias persist for some time, they may cause severe pain, unconsciousness, or death.

MPS-2 offers a wide range of arrhythmia simulations to test the function of patient monitors. MPS-2 can also be used in training clinicians in arrhythmia recognition.

### 4.2 Available Settings

Press ENTER after selecting a parameter to activate that setting.

( \* indicates a one-time event, which is activated each time the ENTER key is pressed )

#### 4.2.1 Premature Atrial Contraction (PAC)

- PAC on every 10<sup>th</sup> beat

#### 4.2.2 Premature Nodal Contraction (PNC)

- PNC on every 10<sup>th</sup> beat

#### 4.2.3 Multifocal Premature Ventricular Contraction (MF PVC)

- Occasional: MF PVC on every 20<sup>th</sup> beat
- Frequent: MF PVC on every 10<sup>th</sup> beat

#### 4.2.4 Asystole

- Asystole 1: flat line

**4.2.5 Premature Ventricular Contraction, Type 1 (PVC1)**

- Left Ventricular Focus (LVF)\*
- Early LVF\*
- R-on-T LVF\*
- 6, 12, and 24 per minute
- Pair\*
- Run of 5, run of 11

**4.2.6 Premature Ventricular Contraction, Type 2 (PVC2)**

- Right Ventricular Focus (RVF)\*
- Early RVF\*
- R-on-T RVF\*
- 6, 12, and 24 per minute
- Pair\*
- Run of 5, run of 11

**4.2.7 Bigeminy**

- With PVC type 1 (PVC1)
- With PVC type 2 (PVC2)

**4.2.8 Trigeminy**

- With PVC type 1 (PVC1)
- With PVC type 2 (PVC2)

**4.2.9 First Degree Heart Block**

- At 80BPM, with PR interval of 0.25 seconds

**4.2.10 Second Degree Heart Block, Type1**

- Wenckebach: an increasing PR interval followed by a P wave only, with no QRS response.

**4.2.11 Third Degree Heart Block**

- P wave rate of 80 BPM and QRS rate of 30 BPM

**4.2.12 Right Bundle Branch Block**

- PR interval of 0.16 seconds

**4.2.13 Left Bundle Branch Block**

- PR interval of 0.16 seconds

**4.2.14 Fibrillation**

- Coarse atrial fibrillation
- Fine atrial fibrillation
- Coarse ventricular fibrillation
- Fine ventricular fibrillation

#### 4.2.15 Paroxysmal Atrial Tachycardia

- 160 BPM for 5 seconds and normal 80 BPM sinus rhythm for 12 seconds

#### 4.2.16 Supraventricular Tachycardia

- Normal sinus rhythm, but at 160 BPM

#### 4.2.17 Atrial Flutter

#### 4.2.18 Sinus Arrhythmia

#### 4.2.19 Missed Beats

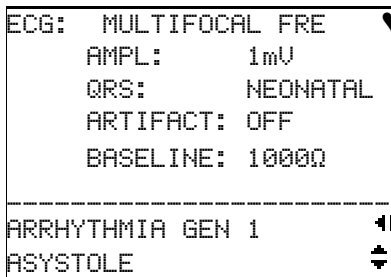
- Manual: triggered by ENTER key (\*)
- At 80 BPM: every 10<sup>th</sup> beat is missed
- At 120 BPM: every 10<sup>th</sup> beat is missed

#### 4.2.20 Nodal Rhythm

### 4.3 Arrhythmia Function

The arrhythmia simulations of MPS-2 have been grouped into eight categories: GEN1 (general #1); PVC1; PVC2; (conduction) BLOCK; FIBRILL (fibrillation), TACHY (tachycardia); and GEN2 (general #2).

Press the Menu key, until the ECG, ARR, PERF line is displayed on the bottom line of the screen. Press the 'soft-key' below the ARR menu label to change the LCD display to that of **Figure 17**, the ARRHYTHMIA main menu.



**Figure 17:** MPS-2 ARRHYTHMIA Main (General Group 1) Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the arrhythmia waveforms provided under "GENERAL" group #1: ASYSTOLE , BIGEMINY 1 PVC1, BIGEMINY 2 PVC2, TRIGEMINY 1 PVC 1, TRIGEMINY 2 PVC2, PAC, PNC, MULTIFOCAL PVC, and FREQUENT MF PVC.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 18**.

```
ECG: MULTIFOCAL FRE ♥
    AMPL:      1mV
    QRS:  NEONATAL
    ARTIFACT:  OFF
    BASELINE: 1000Ω
-----
ARRHYTHMIA: PVC1  ◀▶
PVC1: LVF*        ▲▼
```

**Figure 18:** MPS-2 ARRHYTHMIA PVC Group1 Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the arrhythmia waveforms provided under PVC group #1: PVC1 LVF\*, PVC1 EARLY LVF\*, PVC1 RonT LVF\*, PVC1 6/MIN, PVC1 12/MIN, PVC1 24/MIN, PVC1 PAIR\*, PVC1 RUN 5\*, and PVC1 RUN 11\*.

NOTE: The arrhythmia menus include a wide variety of waveforms identified with an asterisk (\*). This represents an arrhythmia waveform which will be played only once when the ENTER key is pressed, after which the ECG simulation will then revert to normal sinus rhythm (NSR) at 80 BPM. The arrhythmia will be played each time the ENTER key is pressed.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 19**.

```
ECG: MULTIFOCAL FRE ♥
    AMPL:      1mV
    QRS:  NEONATAL
    ARTIFACT:  OFF
    BASELINE: 1000Ω
-----
ARRHYTHMIA: PVC2  ◀▶
PVC2 RVF*        ▲▼
```

**Figure 19:** MPS-2 ARRHYTHMIA PVC Group2 Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the arrhythmia waveforms provided under PVC group #2: PVC2 RVF\*, PVC2 EARLY RVF\*, PVC2 RonT RVF\*, PVC2 6/MIN, PVC2 12/MIN, PVC2 24/MIN, PVC2 PAIR\*, PVC2 RUN 5\*, and PVC2 RUN 11\*.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 20**.

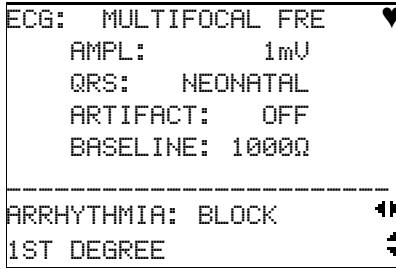


Figure 20: MPS-2 ARRHYTHMIA Block Group Menu

Press the UP (▲) or DOWN(▼) arrow button to scroll through the arrhythmia waveforms provided under the conduction block group: 1ST DEGREE, 2ND DEGREE TYPE1, 3RD DEGREE, RIGHT BUNDLE, and LEFT BUNDLE.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 21**.

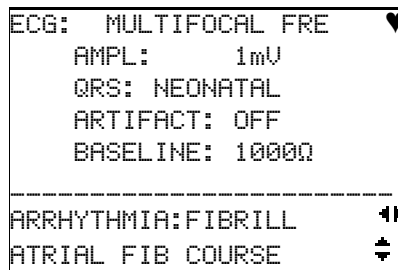


Figure 21: MPS-2 ARRHYTHMIA Fibrillation Group Menu

Press the UP (▲) or DOWN(▼) arrow button to scroll through the arrhythmia waveforms provided under the fibrillation group: ATRIAL FIB COARSE, ATRIAL FIB FINE, VENTRICULAR COARSE, and VENTRICULAR FINE.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 22**.

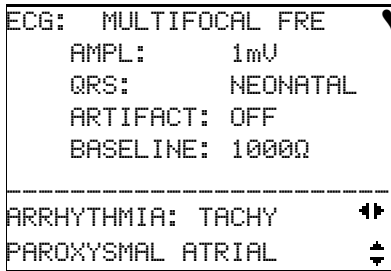


Figure 22: MPS-2 ARRHYTHMIA TACHYCARDIA Group Menu

Press the UP (▲) or DOWN(▼) arrow button to scroll through the arrhythmia waveforms provided under the tachycardia group: PAROXYSMAL, SUPRAVENT and VENTRICULAR TACH.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of Figure 23.

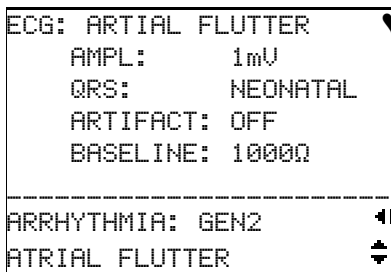


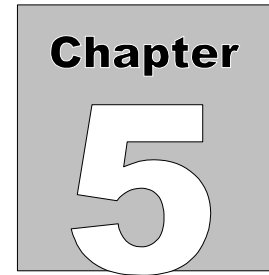
Figure 23: MPS-2 ARRHYTHMIA GENERAL Group2 Menu

Press the UP (▲) or DOWN(▼) arrow button to scroll through the arrhythmia waveforms provided under "GENERAL" group #2: ATRIAL FLUTTER, SINUS, MISSED BEAT\*, MISSED BT 80BPM, MISSED BT 120BPM, and NODAL.

Pressing the RIGHT (▶) arrow button will restore the LCD display to the initial menu screen of Figure 17.

Press the LEFT (◀) arrow button to scroll the display through the above arrhythmia submenus in reverse order.

Press ENTER after selecting an arrhythmia to activate the simulation.



## 5 Performance Waveforms

### 5.1 Overview

MPS-2 offers a number of performance waveforms to evaluate linearity, frequency response, R-wave detection and other aspects of the performance of patient monitors and chart recorders.

When Performance Waves are selected, all BP channels are set to a static pressure of zero mmHg, and the respiration rate is set to zero.

### 5.2 Available Settings

Press ENTER after selecting a parameter to activate that setting.

#### 5.2.1 Square Wave

- 2 Hz or 0.125 Hz

#### 5.2.2 Triangle Wave

- 2 Hz

#### 5.2.3 Pulse

- 80 msec, 1 Hz (60BPM)

#### 5.2.4 Sine Waves

- 0.5, 1, 10, 40, 50, 60, and 100 Hz.

### 5.3 ECG Performance Function

Parameters provided for the ECG performance function are: Square, Triangle and Pulse waveform; and Sinusoidal waveform.

Press the Menu key, until the ECG, ARR, PERF line is displayed on the bottom line of the screen. Press the 'soft-key' below the PERF menu label to change the LCD display to that of **Figure 24**, the PERFORMANCE main menu.

```

ECG: SQUARE WAVE 2H  ♥
  AMPL:      1mV
  QRS: NEONATAL
  ARTIFACT: OFF
  BASELINE: 10000
-----
PERFORMANCE SHAPE  ⬅➡
SHAPE: SQUARE 2 Hz  ⬆⬇
  
```

**Figure 24:** MPS-2 PERFORMANCE Shape Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the waveshapes provided: SQUARE 2Hz, TRI 2Hz, PUL 1 Hz 80ms and SQR 0.125Hz.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 25**.

```

ECG: SQUARE WAVE 2H  ♥
  AMPL:      1mV
  QRS: NEONATAL
  ARTIFACT: OFF
  BASELINE: 10000
-----
PERFORMANCE SINE  ⬅➡
SINE: 60 Hz  ⬆⬇
  
```

**Figure 25:** MPS-2 PERFORMANCE Sinusoidal Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the frequencies provided for the sinusoidal waveform: 0.5, 1, 10, 40, 50, 60 and 100 Hz.

Pressing the RIGHT (▶) arrow button will restore the LCD display to the initial menu screen of **Figure 24**.

Press the LEFT (◀) arrow button to scroll the display through the above simulator parameters in reverse order.

Press ENTER after selecting a parameter to activate your selection.



## 6 Invasive Blood Pressure

### 6.1 Overview

Blood pressure (BP) is the force of circulating blood on the walls of the arteries. Blood pressure is taken using two measurements: systolic (measured when the heart beats, when blood pressure is at its highest) and diastolic (measured between heart beats, when blood pressure is at its lowest).

A dynamic blood pressure value is normally written with the systolic blood pressure first, followed by the diastolic blood pressure (for example 120/80) in mmHg.

MPS-2 provides two BP channels and simulates static pressures, as well as dynamic BP waveforms that track arrhythmia and normal sinus ECG simulations.



Figure 26: MPS-2 BP Connections

Respiration artifact of 5 mmHg or 10 mmHg can be selected on all BP channels.

## 6.2 Available Settings

Press ENTER after selecting a parameter to activate that setting.

### 6.2.1 Transducer Sensitivity

- 5 or 40  $\mu\text{V}/\text{V}/\text{mmHg}$

### 6.2.2 Static Levels (all channels)

- -10, -5, 0, 20, 40, 60, 80, 100, 120, 150, 160, 180, 200, 240, 320 and 400 mmHg

### 6.2.3 Dynamic Simulations (all channels)

- Arterial 120/80
- Left Ventricular 120/0
- Right Ventricular 25/0
- Left Atrium 14/4
- Right Atrium 15/10
- Pulmonary Artery 25/10
- Pulmonary Wedge 10/2
- Swan-Ganz Auto
- Swan-Ganz Manual

### 6.2.4 Artifact

- Off
- Respiration 1 (5 mmHg)
- Respiration 2 (10 mmHg)

## 6.3 Blood Pressure Function

Parameters provided for BP 1-2 are: Arterial; Ventricular; Left and Right Atrium; Pulmonary Artery and Wedge; automatic and manual Swan-Ganz simulations.

Press the Menu key, until the BP1, BP2, VIEW line is displayed on the bottom line of the screen. Press the 'soft-key' below the BP1 menu label to change the LCD display to that of **Figure 27**, the BP1 main menu.

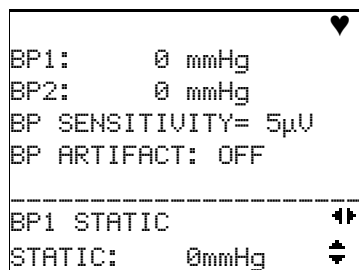


Figure 27: MPS-2 BP1 STATIC Menu

Since both BP channels have the same parameters and options, only BP1 will be described below.

With MPS-2 displaying the menu of **Figure 27**, press the UP (▲) or DOWN(▼) arrow button to scroll through the static levels provided for the low pressure range: -10, -5, 0, 20, 40, 60, 80, 100, 120, 150, 160, 180, 200, 240, 320 and 400 mmHg.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 28**.

```
BP1:      0 mmHg
BP2:      0 mmHg
BP SENSITIVITY= 5µV
BP ARTIFACT: OFF
-----
BP1 DYNAMIC          ▶▶
ARTERIAL: 120/80mmHg  ⚡
```

Figure 28: MPS-2 BP1 DYNAMIC Menu

Press the UP (▲) or DOWN(▼) arrow button to scroll through the simulations of the DYNAMIC 1 group: ART 120/80, ART 90/40, ART 160/110, LT VENT 120/0, RT VENT 25/0, SWGNZ AUTO15s and SWGNZ MANUAL.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 29**.

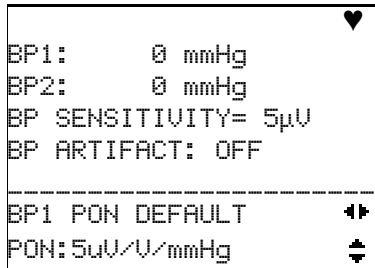
```
BP1:      0 mmHg
BP2:      0 mmHg
BP SENSITIVITY= 5µV
BP ARTIFACT: OFF
-----
BP1 SENSITIVITY      ▶▶
SENS: 5 uV/V/mmHg   ⚡
```

Figure 29: MPS-2 BP1 SENSITIVITY Menu

Pressing the UP (▲) or DOWN (▼) button repeatedly will toggle between the available sensitivity levels: 5 uV/V/mmHg, 40 uV/V/mmHg, SAVE CURRENT BPWAVE.

## MPS-2 OPERATING MANUAL

Pressing the RIGHT (▶) button will change the screen to that of **Figure 30**.

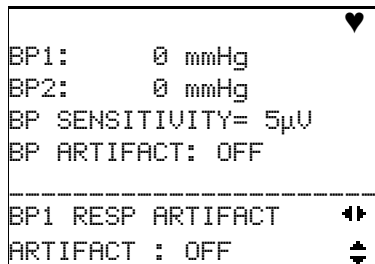


```
BP1:      0 mmHg
BP2:      0 mmHg
BP SENSITIVITY= 5µV
BP ARTIFACT: OFF
-----
BP1 PON DEFAULT  ▶
PON: 5uV/V/mmHg  ▼
```

**Figure 30:** MPS-2 BP1 DEFAULT Menu

Pressing the UP (▲) or DOWN (▼) button will toggle between the available values: 5uV/V/mmHg, 40uV/V/mmHg, SAVE CURRENT BPWAVE. This last selection will save the current dynamic waveform settings for BP1 and BP2 as the new power up settings.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 31**.



```
BP1:      0 mmHg
BP2:      0 mmHg
BP SENSITIVITY= 5µV
BP ARTIFACT: OFF
-----
BP1 RESP ARTIFACT  ▶
ARTIFACT : OFF     ▼
```

**Figure 31:** MPS-2 BP1 ARTIFACT Menu

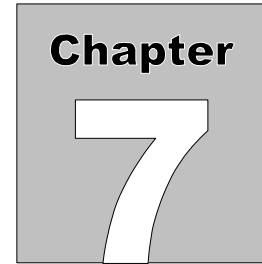
Pressing the UP (▲) button continuously will change between OFF, DELTA 5, DELTA 10.

Pressing the RIGHT (▶) arrow button again will restore the LCD display to the initial menu screen of **Figure 27**.

Press the LEFT (◀) arrow button to scroll the display through the above simulator parameters in reverse order.

Press ENTER after selecting a parameter to activate your selection.

NOTE: Dynamic BP waveforms may be incompatible with certain other functions, for example, ECG performance waveforms. When incompatible ECG or other simulations are selected, BP simulations will be set to static pressure at zero mmHg on all channels.



# 7 Respiration

## 7.1 Overview

MPS-2 sends the respiration signal to either the Left Arm (LA) or Left Leg (LL) ECG lead as selected by through another parameter setting.

## 7.2 Available Settings

Press ENTER after selecting a parameter to activate that setting.

### 7.2.1 Baseline Impedance

- 500, 1000, 1500, and 2000 ohms on Leads I, II, and III

### 7.2.2 Impedance Variation

- 0, 0.2, 0.5, 1, 2, and 3 $\Omega$

### 7.2.3 Rates

- 0, 15, 20 30, 40, 60, 80, 100 and 120 Breaths per Minute (BR/M)

### 7.2.4 Apnea Selections

- 12, 22, 32 seconds and continuous

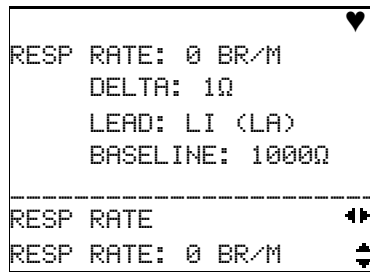
### 7.2.5 Respiratory Effort

- (Inspiration/Expiration Ratio) 5/1, 4/1, 3/1, 2/1, 1/1

## 7.3 Respiration Function

Parameters provided for the respiration function are: Rate, Apnea, Impedance, Delta and I/E Ratio.

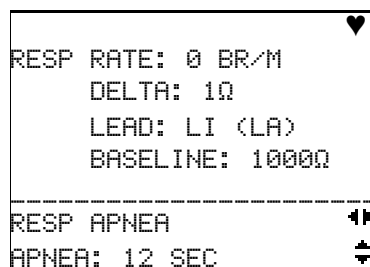
Press the Menu key, until the RESP, PACER, TEMP line is displayed on the bottom line of the screen. Press the 'soft-key' below the RESP menu label to change the LCD display to that of **Figure 32**, the RESP main menu.



**Figure 32:** MPS-2 RESPIRATORY RATE Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the respiration rate: 0, 15, 20, 30, 40, 60, 80, 100 and 120 Breaths per Minute (BPM).

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 33**.



**Figure 33:** MPS-2 RESPIRATORY APNEA Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the apnea time: 12, 22, 32 seconds and CONTINUOUS.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 34**.

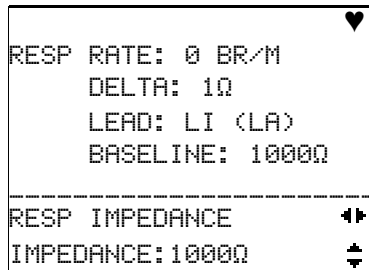


Figure 34: MPS-2 RESPIRATORY IMPEDANCE Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the baseline impedance: 500, 1000, 1500 and 2000Ω.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 35**.

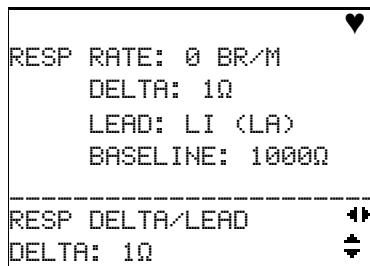


Figure 35: MPS-2 RESPIRATORY DELTA RESISTANCE Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the impedance deviation: 0, 0.2, 0.5, 1, 2 and 3Ω.

Pressing the RIGHT (▶) arrow button will restore the LCD display to the initial menu screen of **Figure 32**.

Press the LEFT (◀) arrow button to scroll the display through the above simulator parameters in reverse order.

Press ENTER after selecting a parameter to activate your selection.





## 8 Pacemaker

### 8.1 Overview

An artificial pacemaker, or "pacer", is a medical device designed to regulate the beating of the heart. External pacemakers can be used for initial stabilization of a patient, but implantation of a permanent pacemaker is sometimes required.

Pacing can be instituted for many reasons: in the case of slow ventricular rate (bradycardia, heart block) or rapid ventricular rate, atrial fibrillation or atrial flutter, or if dangerous arrhythmias are noted when the ECG is monitored.

MPS-2 simulates the presence of a pacer pulse with the ECG signal to allow the evaluation of how a patient monitor deals with the pacer pulse.

### 8.2 Available Settings

Press ENTER after selecting a parameter to activate that setting  
(Below, \* indicates a one-time event, which is activated by pressing the ENTER key)

#### 8.2.1 Rhythms

- Asynchronous at 75 BPM
- Demand with frequent sinus beat (Demand 1)
- Demand with occasional sinus beat (Demand 2)
- A-V sequential
- Non-capture\*
- Non-function

#### 8.2.2 Pacer Pulse Amplitudes

- 2, 4, 8, 10, 12, 14, 16, 18, 20, 50 and 100 mV

#### 8.2.3 Pacer Pulse Widths

- 0.1, 0.2, 0.5, 1.0, and 2.0 msec

#### 8.2.4 Pacer Pulse Polarity

- Positive or Negative.

### 8.3 Pacer Function

Parameters provided for the pacemaker function are: Waveform; Amplitude; Rate; and Polarity.

Press the Menu key, until the RESP, PACER, TEMP line is displayed on the bottom line of the screen. Press the 'soft-key' below the PACER menu label to change the LCD display to that of **Figure 36**, the PACER main menu.

```

ECG: NSR 80 BPM      ♥
  AMPL:      1mV
  QRS: ADULT
  ARTIFACT: OFF
  BASELINE: 10000
-----
PACEMAKER WAVE      ⬆⬆
WAVE: ASYNC 75BPM   ⬇

```

**Figure 36:** MPS-2 PACER WAVEFORM Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the pacing simulations provided: ASYNC 75BPM, DEMAN FRE SIN, DEMAN OCC SIN, AV SEQUENTIAL, NON-CAPTURE\*, and NON-FUNCTION.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 37**.

```

                                     ♥
FACE AMPL:      20mV
  POLARITY: LII=+
  WIDTH:        2mS
-----
PACEMAKER AMPL   ⬆⬆
FACE AMPL: 20mV  ⬇

```

**Figure 37:** MPS-2 PACER AMPLITUDE Menu

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the pacer pulse amplitude: 2, 4, 8, 10, 12, 14, 16, 18, 20, 50, and 100 mV.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 38**.

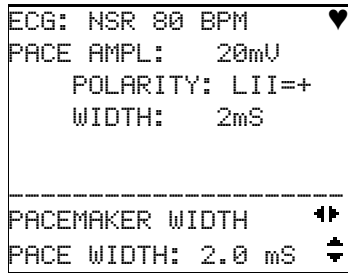


Figure 38: MPS-2 PACER PULSE WIDTH Menu

Press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided for the pacer pulse width: 0.1, 0.2, 0.5, 1.0 and 2.0 milliseconds.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 39**.

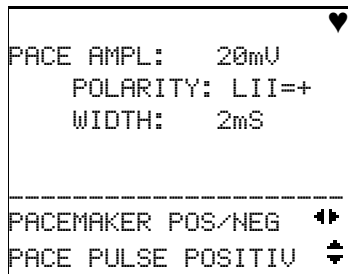


Figure 39: MPS-2 PACER PULSE POLARITY Menu

Press the UP (▲) or DOWN(▼) arrow button to toggle the pacer pulse polarity between positive-going and negative-going.

Pressing the RIGHT (▶) arrow button will restore the LCD display to the initial menu screen of ?.

Press the LEFT (◀) arrow button to scroll the display through the above simulator parameters in reverse order.

Press ENTER after selecting a parameter to activate your selection.



## 9 Temperature

### 9.1 Overview

MPS-2 temperature simulations are compatible with Yellow Springs Inc. (YSI) Series 400 and 700 probes. MPS-2 creates both simulations, and the simulation presented to the monitor is dependent on the adaptor cable connected to the TEMPERATURE jack.

MPS-2 simulates five body temperatures.

### 9.2 Available Settings

Press ENTER after selecting a parameter to activate that setting.

#### 9.2.1 Body Temperatures

- 30, 35, 37, 38, and 40 °C

### 9.3 Temperature Function

In the Temperature function, MPS-2 provides the simulation for temperature based on both the YSI 400 or 700 thermistor, and the output to the monitor is dependent on the adapter cable connected at the TEMPERATURE jack.

Press the Menu key, until the RESP, PACER, TEMP line is displayed on the bottom line of the screen. Press the 'soft-key' below the TEMP menu label to change the LCD display to that of **Figure 40**, the TEMPERATURE main menu.

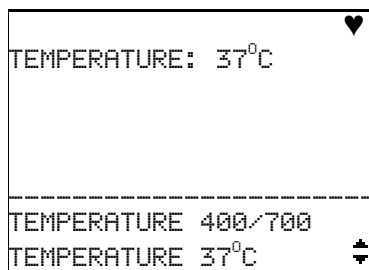


Figure 40: MPS-2 TEMPERATURE Menu

## MPS-2 OPERATING MANUAL

The only adjustment provided by this menu is the temperature value, therefore, the LEFT (◀) and RIGHT (▶) arrows are not displayed. Pressing them will have no effect on the MPS-2.

Press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided for the body temperature: 30, 35, 37, 38 and 40 °C. Press ENTER to activate the temperature selection.

**Chapter**  
**10**

## 10 Automated Settings

### 10.1 Overview

The Automated Settings of MPS-2 provide ten patient simulation setups which are user-programmable. These setups allow multiple simulation parameters to be simultaneously modified in as little as two keystrokes, without affecting the power-on default settings of the simulator.

The Auto setups are created or modified using terminal emulation software via the RS-232 port. Programs such as Hyperterminal or the MPS2PC software (see Chapter 14) may be used.

### 10.2 Choosing an Auto Setting

Press the Menu key, until the AUTO, SAVE, SETUP line is displayed on the bottom line of the screen. Press the 'soft-key' below the AUTO menu label to change the LCD display to that of **Figure 41**, the AUTO SELECTIONS main menu.

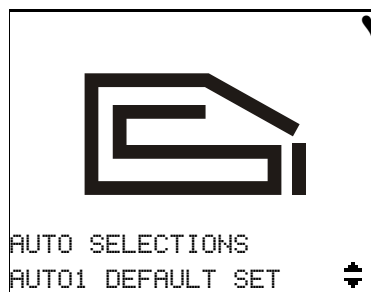


Figure 41: MPS-2 AUTO SELECTIONS Menu

AUTO SELECTIONS mode provides space in memory for up to 10 pre-defined Function/Parameter/Setting protocols. Within each AUTO SELECTION, there are 10 individual SETTINGS that can be set. The AUTO SELECTIONS are easily created using the RS-232 commands through the MPS2PC program included with your MPS-2. When an AUTO SELECTION is activated, the individual settings within the protocol are enabled sequentially based on the memory allocation for the protocol, enabling settings at lower memory locations first and progressing through the memory until complete. The first AUTO SELECTION is preset at the factory and it is recommended that it is not changed.

In AUTO SELECTIONS mode, the only adjustment is the selection of a different AUTO SELECTION, therefore, the LEFT and RIGHT arrows are not displayed. Pressing them will have no effect on the MPS-2.

Pressing the UP (▲) arrow button repeatedly will scroll through the available AUTO1 - AUTO10 values.

Pressing the MENU button will change the screen back to that of **Figure 1**.

Once an AUTO SELECTION has been chosen, the simulator parameters configured by that selection will remain in effect until one or more of the parameters are modified via the various menus provided by MPS-2, or until MPS-2 is powered down.



# 11 VIEWing the Settings

## 11.1 Overview

The MPS-2 provides the capability of determining the state of each of the function/parameter/setting currently active on the unit. The VIEW function will display a number of screens, each of which will display the parameter settings of a particular function. Each press of ENTER when VIEW has been selected will advance through the VIEW screens, function by function to display the status of all the parameter settings.

## 11.2 Choosing an VIEW screen

Press the Menu key, until the BP1, BP2, VIEW line is displayed on the bottom line of the screen. Press the 'soft-key' below the VIEW menu label to change the LCD display to that of **Figure 42**, the VIEW main menu.

The VIEW screen displays the SETTINGS on several separate screens, providing information for each of the Functions and Parameters currently in use.



Figure 42: MPS-2 ECG VIEW Menu

The VIEW screens can be stepped through by pressing the ENTER key multiple times. To exit the VIEW, press the MENU key. When you re-enter the VIEW menu, you will enter on the screen following the last one that was viewed.

Typical VIEW screens are shown below.

```
ECG: NSR 80 BPM
    AMPL: 1mV
    QRS: ADULT
    ARTIFACT: OFF
    BASELINE: 10000
-----
VIEW SETTINGS
VIEW CURRENT SETTINGS
```

Figure 43: MPS-2 ECG VIEW SCREEN

```
BP1: 0 mmHg
BP2: 0 mmHg
BP SENSITIVITY= 5µV
BP ARTIFACT: OFF
-----
VIEW SETTINGS
VIEW CURRENT SETTINGS
```

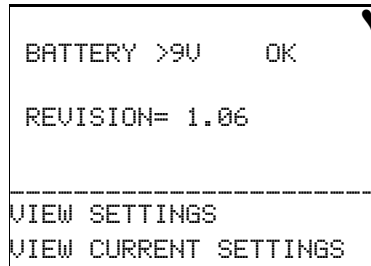
Figure 44: MPS-2 BP VIEW SCREEN

```
RESP RATE: 20 BR/M
    DELTA: 10
    LEAD: LI (LA)
    BASELINE: 10000
-----
VIEW SETTINGS
VIEW CURRENT SETTINGS
```

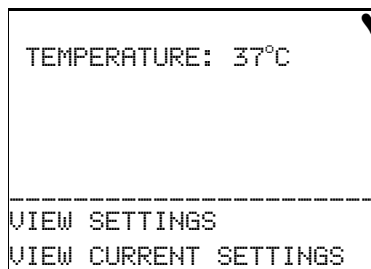
Figure 45: MPS-2 RESPIRATION VIEW SCREEN

```
PACE AMPL: 20mV
    POLARITY: LII=+
    WIDTH: 2mS
-----
VIEW SETTINGS
VIEW CURRENT SETTINGS
```

Figure 46: MPS-2 PACER VIEW SCREEN



**Figure 47:** MPS-2 GENERAL VIEW SCREEN



**Figure 48:** MPS-2 TEMPERATURE VIEW SCREEN

Pressing any of the ARROW keys will change the screen back to that of **Figure 42**.

Pressing the MENU button will change the screen back to that of **Figure 1**.

Pressing the AMPLITUDE button will change the screen to the ECG VIEW screen and the ECG amplitude to the next setting in the circular buffer.



## 12 SETUP Configuration

### 12.1 Overview

MPS-2 has a number of configuration options for the display and the beeper.

### 12.2 Choosing a Configuration Option

Press the Menu key, until the AUTO, SAVE, SETUP line is displayed on the bottom line of the screen. Press the 'soft-key' below the SETUP menu label to change the LCD display to that of **Figure 49**, the CONFIGURATION or AUXILARY menu.

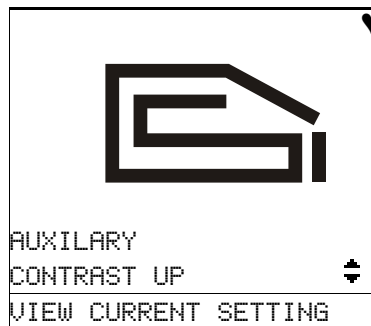


Figure 49

The available selections are: CONTRAST UP, CONTRAST DOWN, BACKGROUND LIGHT, BACKGROUND DARK, BEEPER OFF, BEEPER ON, BEEP TEST, DISPLAY LIGHT OFF, DISPLAY 5 SEC, DISPLAY 8 SEC, DISPLAY 10 SEC.

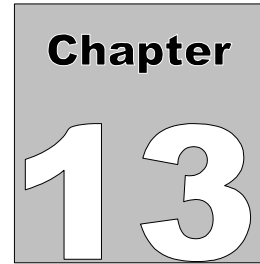
The CONTRAST UP, CONTRAST DOWN selections will adjust the darkness of the text on the background.

The BACKGROUND LIGHT, BACKGROUND DARK selections will change the display from dark text on a light background to light text on a dark background (reverse video).

The BEEPER OFF, BEEPER ON, BEEP TEST selections are self explanatory.

The DISPLAY LIGHT OFF, DISPLAY 5 SEC, DISPLAY 8 SEC, DISPLAY 10 SEC selections will determine if the display will be back lit and for how long before it turns off automatically. If the DISPLAY LIGHT is set to 8 seconds, when a keypress is detected, the backlight will turn on for 8 seconds and then turn off unless another keypress is detected. The backlight will turn off at 5, 8 or 10 seconds after the last keypress detected.

Pressing the MENU button will change the screen back to that of **Figure 1**.



## 13 Controlling MPS-2 with a PC

### 13.1 Overview

MPS-2 may be controlled directly from a personal computer via RS-232. Control is effected by sending 3 digit numeric codes to MPS-2. The numeric codes can be found in Appendix A.

### 13.2 Connecting MPS-2 to a PC

Connect the serial communications cable (P/N 3140-429) provided with MPS-2 to the DB9/RJ12 adapter (P/N 3140-426).

Connect the DB9 of the adapter to a serial communications port ("COM Port") on your PC, and insert the other end of the cable into RS-232 port of MPS-2.

Power up MPS-2 by pressing the POWER pushbutton. There is no need to set MPS-2 to a particular mode for computer communications, it is ready to accept control commands as soon as it is powered ON.

The serial protocol used by MPS-2 is **9600,N,8,1** (9600 baud; no parity; 8 data bits; 1 stop bit). Any serial communications program, such as Hyperterminal, that allows characters to be sent one at a time will work to send the control commands.

### 13.3 MPS-2 Command Interface Specifications

The remote commands which control MPS-2 are listed in section 13.4 of this operating manual. Remote commands comprise one, two, or three ASCII numerals (character set '0' to '9'), terminated by the ASCII 'E' character. Carriage return, line feed, and similar ASCII control characters *must not be sent* by the controlling device to MPS-2.

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Command examples:

<u>Description</u>	<u>Command</u>
Set ECG to NSR, 80BPM	4
Set ECG to Coarse AFIB	104
Set ECG to NSR, 120BPM	15
Set BP channel 1 to 160/110	181

MPS-2 has special requirements for remote control via RS-232. Characters sent to MPS-2 by a controlling device must be separated by a delay of at least two-tenths of a second.

For example, considering the Coarse AFIB command listed above, the sending device will require at least 0.8 seconds to send this message to MPS-2. After the first ASCII character '1' is sent, there needs to be a 0.2 second pause to allow the MPS-2 to recognize the character. After the pause, the second ASCII character '0' may be sent, etc. Sending the ASCII character 'E' is equivalent to pressing the ENTER key on the keypad.

### **13.4 MPS-2 Command Structure**

The remote commands which control MPS-2 are listed below:

#### **13.4.1 Enter NUMERIC Setting Command**

Syntax:           XXX

Description:       The NUMERIC Setting command prepares to initiate a specific Parameter of a Function at a specific Setting. Each Function/Parameter/ Setting has an assigned numeric code for reference (see Appendix A). For instance, ECG/RATE/240BPM has a numeric code of "014". Type the numeric code, the leading 0's are optional.

Example:           "014" prepare to initiate ECG/RATE/240BPM

Returns:           If there are too many characters received, AMPS will sound a double beep.



### **13.4.2 Activate Setting Command**

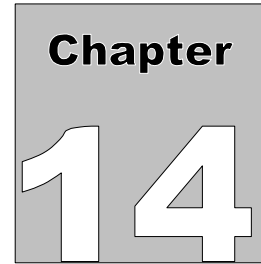
Syntax: E

Description: The E character acts as an Enter keystroke, activating the numeric entry

Example: "014E" prepares to initiate ECG/RATE/240BPM, then activates or 'E'nters the command

Returns: 2 beeps if an error occurs





## 14 Configuring MPS-2 with a PC

### 14.1 Overview

The MPS-2 Configuration Editor software *MPS2PC* facilitates user editing of the configurable parameters of MPS-2 with a PC. There are two categories of parameters that can be configured through a PC connected to the RS-232 port of MPS-2. The first category is power on setting. These parameters represent the default behaviors of MPS-2 after power up. The second category is auto selection setting, as described in Chapter 10. In the next sections the detailed operations of the Configuration Editor software will be given.

### 14.2 Starting *MPS2PC*

The *MPS2PC* consists of two files, *MPS2PC.EXE* and *DEFAULT.INI*. These files can be copied to a specific folder on the PC's hard drive for convenient access.

To start the Configuration Editor, run *MPS2PC.EXE* and the following window (**Figure 50**) will show on the screen.

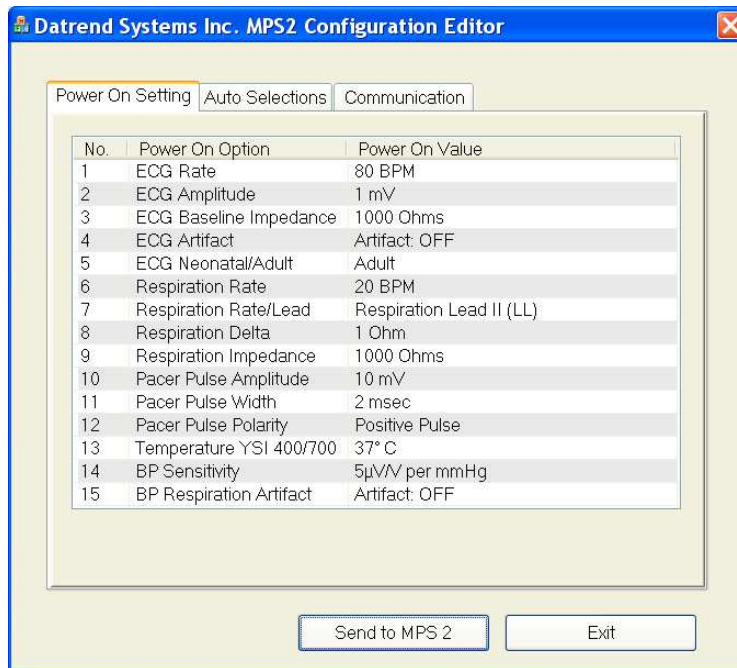


Figure 50-Start up Screen of MPS-2 Configuration Editor

### 14.3 Setting up Communication with MPS-2

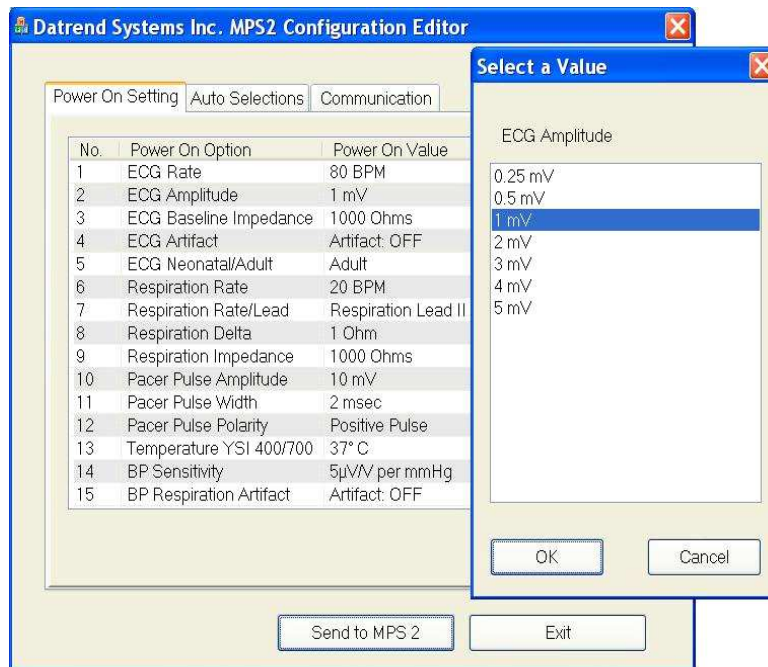
Connect the serial communications cable (P/N 3140-429) provided with MPS-2 to the DB9/RJ12 adapter (P/N 3140-426).

Connect the DB9 of the adapter to a serial communications port ("COM Port") on your PC, and insert the other end of the cable into RS-232 port of MPS-2.

From the *MPS2PC*, click the Communication tab. Make sure the com port setting corresponds to the com port you selected on your PC.

## 14.4 Configuring the Power on Setting of MPS-2

From the Power on Setting tab, 15 parameters of the MPS-2 can be changed. In order to change one of the parameters, double click the row corresponding to that parameter, then select the desired value from the pop-up window, see **Figure 51**. Click OK to validate the change, or Cancel to cancel the change.



**Figure 51** - Example of changing ECG Amplitude

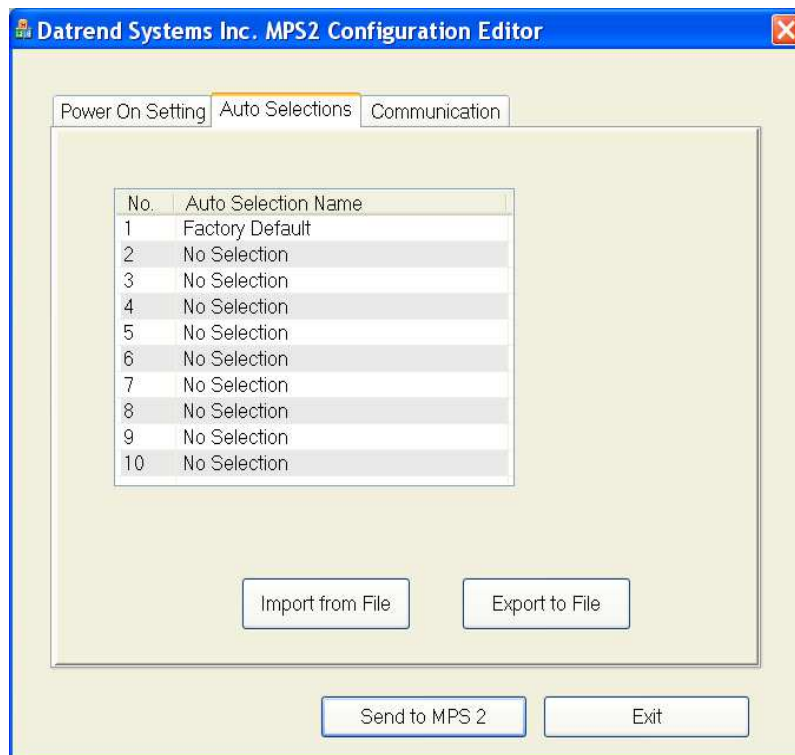
After all parameters are changed, they can be sent to MPS-2 through the RS-232 connection by clicking the Send to MPS-2 button. It takes about 10 seconds for the transfer to finish.

For the settings to take effect, it is necessary to restart MPS-2 by switching the power off, waiting one second, then switching the power back on.

## 14.5 Configuring the Auto Selections of MPS-2

The Auto Selections feature allows you to create or modify up to 10 custom simulation setups for MPS-2. After uploading the Auto setups to MPS-2, multiple simulation parameters can then be quickly changed at once, via the AUTO menu operations of MPS-2.

Click the Auto Selections tab to display the following window (**Figure 52**) in the configuration editor. To edit one of the auto selections, double click the row corresponding to that auto selection, and the Auto Selection Editor window will pop-up as shown in **Figure 53**.



**Figure 52** - Configuring Auto Selections

Any Auto selection may include up to 10 parameter settings. *MPS2PC* organizes Auto selections into four Categories. Parameters and settings vary by Category, but all Categories include settings for Body Temperature. The desired Category is selected by clicking the “Type” combo box in the Auto Selection Editor, see **Figure 53**.

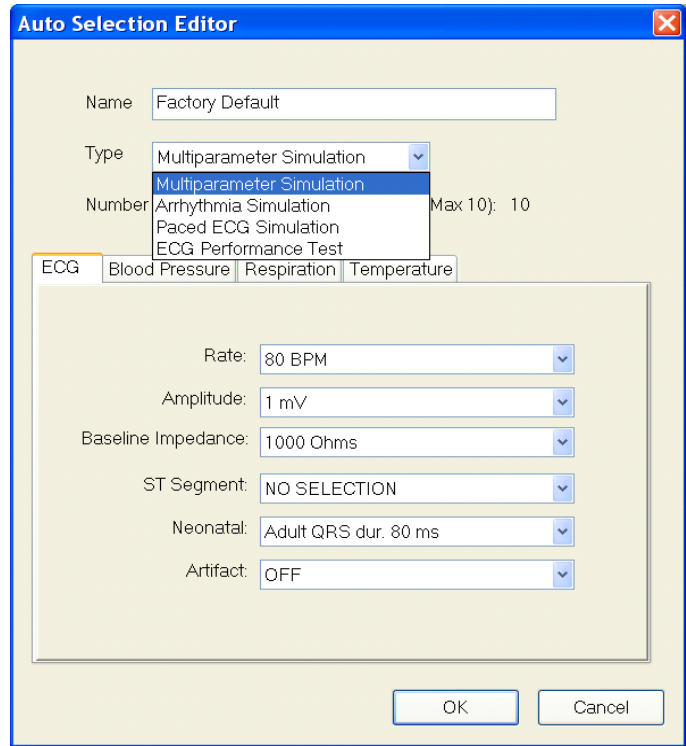


Figure 53 - AUTO Selection Editor

Below is an overview of all auto selection types.

Type: Multi-parameter Simulation

ECG Tab:

- Rate
- Amplitude
- Baseline Impedance
- ST Segment
- Neonatal
- Artifact

Blood Pressure Tab:

- Sensitivity
- Static Level
- BP1 Dynamic
- BP2 Dynamic
- Artifact

Respiration Tab:

- Rate
- Apnea
- Delta
- Lead

Temperature Tab (available in all Types):

- Temperature YSI 400/700

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Type: Arrhythmia Simulation

Arrhythmia Tab:  
Arrhythmia Waveform

Temperature Tab:  
(See above)

Type: Paced ECG Simulation

Pacer Tab:  
Waveform  
Pulse Polarity  
Pulse Amplitude  
Pulse Width

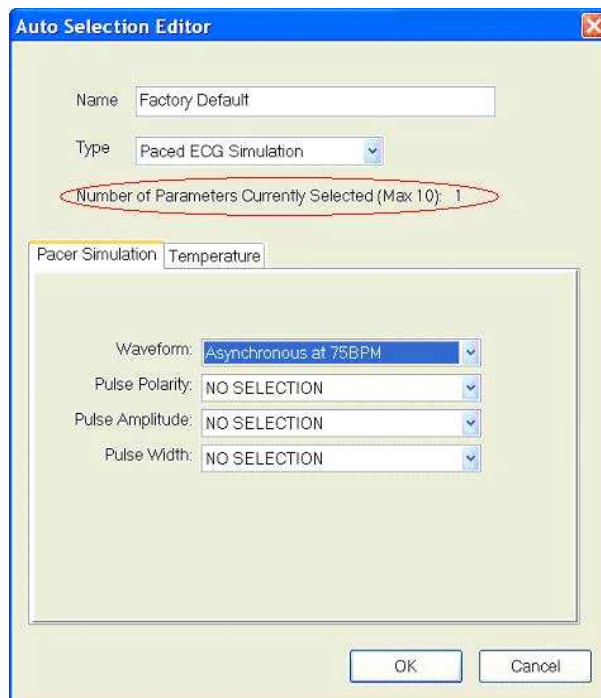
Temperature Tab:  
(See above)

Type: ECG Performance Simulation

Performance Tab:  
Waveform

Temperature Tab:  
(See above)

The Auto Selection Editor keeps track of the number of parameter selected as shown in **Figure 54**. If this number reaches 10 (which is only possible for Multiparameter Simulation type), any further selection of parameters is inhibited.



**Figure 54** - Number of Parameters Selected In Auto Selection Editor



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You can name or rename any of the Auto selections, but the names will not be sent to MPS-2. Instead, the names of the auto selections can only be saved in an exported file for future reference. The file export and import features are available from the *MPS2PC* main window (**Figure 52**). The exported files are in text format and can also be edited with any text editor.

When you are finished editing the Auto setups, click OK to exit the editor. Press “Send to MPS-2” button to upload the Auto setups to MPS-2 via the RS-232 connection. It takes about 1 minute for the transfer to finish.

For the settings to take effect, it is necessary to restart MPS-2. After uploading, reset MPS-2 by switching the power off, waiting one second, then switching the power back on.



Chapter  
**15**

## 15 Calibration and Maintenance

Calibration of MPS-2 by an authorized Datrend Service Facility is required on an *annual* basis to maintain the 5 year factory warranty. Refer to the Calibration Decal applied on the back of the unit to determine calibration status of your MPS-2.

MPS-2 contains no user serviceable parts. *Opening the case of MPS-2 for any reason will void the warranty.*

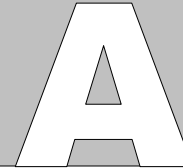
For calibration or service assistance, contact Datrend for a Return Materials Authorization (RMA) number or the location of the nearest Service Facility.

Datrend Systems Inc.  
Unit 130 - 4020 Viking Way  
Richmond, BC • CANADA • V6V 2L4  
Tel: 800.667.6557 (North America Only) or  
604.291.7747 • Fax 604.294.2355  
e-mail [customerservice@datrend.com](mailto:customerservice@datrend.com)  
[www.datrend.com](http://www.datrend.com)

MPS-2 should be cleaned with a soft, lint free, damp cloth. Use of cleaning agents may result in scratching, discoloration, or streaking.




 Appendix


 A

## Appendix A - Numeric Codes

Every function or setting provided by MPS-2 corresponds to a preset 1, 2 or 3 digit number or code. When MPS-2 receives a NUMERIC mode via RS-232, the desired function or setting will activate. There are approximately 300 selections available, numbered from zero to 511, as listed in the table in this Appendix.

The table on the following page lists the numeric codes for all MPS-2 settings. Find the desired setting in the table, send the corresponding 1, 2 or 3 digit code via RS-232, followed by the E character, to activate that setting.

RS232 CODE	SELECTION	NOTE-* ONE TIME EVENT
CODE= 0	SELECTION NUMBER	
CODE= 1	NSR RATE +UP	
CODE= 2	NSR RATE -DOWN	
CODE= 3	NSR 30 BPM	
CODE= 4	NSR 40 BPM	
CODE= 5	NSR 60 BPM	
CODE= 6	NSR 80 BPM	
CODE= 7	NSR 100 BPM	
CODE= 8	NSR 120 BPM	
CODE= 9	NSR 140 BPM	
CODE= 10	NSR 160 BPM	
CODE= 11	NSR 180 BPM	
CODE= 12	NSR 200 BPM	
CODE= 13	NSR 220 BPM	
CODE= 14	NSR 240 BPM	
CODE= 15	NSR 260 BPM	
CODE= 16	NSR 280 BPM	
CODE= 17	NSR 300 BPM	
CODE= 18	NO SELECTION	
CODE= 19	ECG SENS +UP	
CODE= 20	ECG SENS -DOWN	
CODE= 21	ECG SENS LII AT 0.25 MV	
CODE= 22	ECG SENS LII AT 0.5 MV	
CODE= 23	ECG SENS LII AT 1 MV	
CODE= 24	ECG SENS LII AT 2 MV	
CODE= 25	ECG SENS LII AT 3 MV	

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CODE= 26	ECG SENS LII AT 4 MV
CODE= 27	ECG SENS LII AT 5 MV
CODE= 28	NO SELECTION
CODE= 29	BASELINE + UP
CODE= 30	ECG BASELINE AT 500 OHMS
CODE= 31	ECG BASELINE AT 1000 OHMS
CODE= 32	ECG BASELINE AT 1500 OHMS
CODE= 33	ECG BASELINE AT 2000 OHMS
CODE= 34	NO SELECTION
CODE= 35	ECG ARTIFACT OFF
CODE= 36	ECG ARTIFACT AT 60HZ
CODE= 37	ECG ARTIFACT AT 50HZ
CODE= 38	ECG ARTIFACT AT MUSCLE
CODE= 39	ECG ARTIFACT AT BASELINE WANDERING
CODE= 40	NO SELECTION
CODE= 41	ST ELEVATION +UP
CODE= 42	ST ELEVATION -DOWN
CODE= 43	ST ELEVATION AT -0.8MV
CODE= 44	ST ELEVATION AT -0.7MV
CODE= 45	ST ELEVATION AT -0.6MV
CODE= 46	ST ELEVATION AT -0.5MV
CODE= 47	ST ELEVATION AT -0.4MV
CODE= 48	ST ELEVATION AT -0.3MV
CODE= 49	ST ELEVATION AT -0.2MV
CODE= 50	ST ELEVATION AT -0.1MV
CODE= 51	ST ELEVATION AT 0MV
CODE= 53	ST ELEVATION AT +0.2MV
CODE= 54	ST ELEVATION AT +0.3MV
CODE= 55	ST ELEVATION AT +0.4MV
CODE= 56	ST ELEVATION AT +0.5MV
CODE= 57	ST ELEVATION AT +0.6MV
CODE= 58	ST ELEVATION AT +0.7MV
CODE= 59	ST ELEVATION AT +0.8MV
CODE= 60	NO SELECTION
CODE= 61	ADULT QRS DURATION AT 80MSEC
CODE= 62	NEONATAL QRS DURATION AT 40MSEC
CODE= 63	NO SELECTION
CODE= 64	ASYSTOLE
CODE= 65	BIGEMINY PVC1 LVF
CODE= 66	BIGEMINY PVC2 RVF
CODE= 67	TRIGEMINY PVC1 LVF
CODE= 68	TRIGEMINY PVC2 RVF
CODE= 69	PREMATURE ATRIAL CONTRACTION
CODE= 70	PREMATURE NODAL CONTRACTION
CODE= 71	MULTIFOCAL PVCS
CODE= 72	FREQUENT MULTIFOCAL PVCS
CODE= 73	NO SELECTION
CODE= 74	PVC1 LVF *
CODE= 75	PVC1 LVF EARLY *
CODE= 76	PVC1 LVF R ON T *
CODE= 77	PVC1 LVF 6/MIN
CODE= 78	PVC1 LVF 12/MIN
CODE= 79	PVC1 LVF 24/MIN

## MPS-2 OPERATING MANUAL

CODE= 80	PVC1 LVF PAIR *
CODE= 81	PVC1 LVF RUN OF 5 *
CODE= 82	PVC1 LVF RUN OF 11 *
CODE= 83	NO SELECTION
CODE= 84	PVC2 RVF *
CODE= 85	PVC2 RVF EARLY *
CODE= 86	PVC2 RVF R ON T *
CODE= 87	PVC2 RVF 6/MIN
CODE= 88	PVC2 RVF 12/MIN
CODE= 89	PVC2 RVF 24/MIN
CODE= 90	PVC2 RVF PAIR *
CODE= 91	PVC2 RVF RUN OF 5 *
CODE= 92	PVC2 RVF RUN OF 11 *
CODE= 93	NO SELECTION
CODE= 94	FIRST DEGREE BLOCK
CODE= 95	SECOND DEGREE BLOCK
CODE= 96	THIRD DEGREE BLOCK
CODE= 97	RIGHT BB BLOCK
CODE= 98	LEFT BB BLOCK
CODE= 99	NO SELECTION
CODE= 100	ATRIAL FIB COARSE
CODE= 101	ATRIAL FIB FINE
CODE= 102	VENTRICULAR FIB COARSE
CODE= 103	VENTRICULAR FIB FINE
CODE= 104	NO SELECTION
CODE= 105	PAROXYSMAL ATRIAL TACHYCARDIA
CODE= 106	SUPRAVENTRICULAR TACHYCARDIA
CODE= 107	VENTRICULAR TACHYCARDIA
CODE= 108	NO SELECTION
CODE= 109	ATRIAL FLUTTER
CODE= 110	SINUS
CODE= 111	MISSED BEAT *
CODE= 112	MISSED BEAT NSR RATE AT 80BPM
CODE= 113	MISSED BEAT NSR RATE AT 120BPM
CODE= 114	NODAL RYTHM
CODE= 115	NO SELECTION
CODE= 116	BP CHANNELS AT 0MMHG
CODE= 117	SET BP DYANMAIC WAVES
CODE= 118	BP1 ARTERIAL
CODE= 119	BP1 LEFT VENTRICLE
CODE= 120	BP1 RIGHT VENTRICLE
CODE= 121	BP1 LEFT ATRIUM
CODE= 122	BP1 RIGHT ATRIUM/CENTRAL VENOUS
CODE= 123	BP1 PULMUNARY ARTERY
CODE= 124	BP1 PULMONARY ARTERY WEDGE
CODE= 125	BP1 SWAN GANZ AUTO
CODE= 126	BP1 SWAN GANZ MANUAL
CODE= 127	NO SELECTION
CODE= 128	BP CHANNELS AT 0MMHG
CODE= 129	SET BP DYNAMIC WAVES
CODE= 130	BP2 ARTERIAL
CODE= 131	BP2 LEFT VENTRICLE
CODE= 132	BP2 RIGHT VENTRICLE

## MPS-2 OPERATING MANUAL

CODE= 133	BP2 LEFT ATRIUM
CODE= 134	BP2 RIGHT ATRIUM/CENTRAL VENOUS
CODE= 135	BP2 PULMONARY ARTERY
CODE= 136	BP2 PULMONARY ARTERY WEDGE
CODE= 137	BP2 SWAN GANZ AUTO
CODE= 138	BP2 SWAN GANZ MANUAL
CODE= 139	NO SELECTION
CODE= 140	BP CHANNELS STATIC STEPS +UP
CODE= 141	BP CHANNELS STATIC STEPS -DOWN
CODE= 142	BP CHANNELS AT -10MMHG
CODE= 143	BP CHANNELS AT -5MMHG
CODE= 144	BP CHANNELS AT 0MMHG
CODE= 145	BP CHANNELS AT 20MMHG
CODE= 146	BP CHANNELS AT 40MMHG
CODE= 147	BP CHANNELS AT 60MMHG
CODE= 148	BP CHANNELS AT 80MMHG
CODE= 149	BP CHANNELS AT 100MMHG
CODE= 150	BP CHANNELS AT 120MMHG
CODE= 151	BP CHANNELS AT 140MMHG
CODE= 152	BP CHANNELS AT 160MMHG
CODE= 153	BP CHANNELS AT 180MMHG
CODE= 154	BP CHANNELS AT 200MMHG
CODE= 155	BP CHANNELS AT 240MMHG
CODE= 156	BP CHANNELS AT 320MMHG
CODE= 157	BP CHANNELS AT 400MMHG
CODE= 158	NO SELECTION
CODE= 159	BP CHANNELS SENS AT 5MICROVOLTS
CODE= 160	BPCHANNELS SENS AT 40MICROVOLTS
CODE= 161	SAVE CURRENT BP WAVE SELECTIONS FOR PON
CODE= 162	NO SELECTION
CODE= 163	BP CHANNELS AT 5MICROVOLTS ON POWER UP
CODE= 164	BP CHANNELS AT 40MICROVOLTS ON POWER UP
CODE= 165	SAVE CURRENT BP WAVE SELECTIONS FOR POWER ON
CODE= 166	NO SELECTION
CODE= 167	BP RESP ARTIFACT 0 TO 5MMHG
CODE= 168	BP RESP ARTIFACT 0 TO 10MMHG
CODE= 169	BP RESP ARTIFACT OFF
CODE= 170	NO SELECTION
CODE= 171	EXECUTE AUTO SELECTION 1 NOTE-DO NOT USE IN RS232 OR AUTO
CODE= 172	EXECUTE AUTO SELECTION 2 NOTE-DO NOT USE IN RS232 OR AUTO
CODE= 173	EXECUTE AUTO SELECTION 3 NOTE-DO NOT USE IN RS232 OR AUTO
CODE= 174	EXECUTE AUTO SELECTION 4 NOTE-DO NOT USE IN RS232 OR AUTO
CODE= 175	EXECUTE AUTO SELECTION 5 NOTE-DO NOT USE IN RS232 OR AUTO
CODE= 176	EXECUTE AUTO SELECTION 6 NOTE-DO NOT USE IN RS232 OR AUTO
CODE= 177	EXECUTE AUTO SELECTION 7 NOTE-DO NOT USE IN RS232 OR AUTO
CODE= 178	EXECUTE AUTO SELECTION 8 NOTE-DO NOT USE IN



**MPS-2 OPERATING MANUAL**

CODE= 179	EXECUTE AUTO SELECTION 9	RS232 OR AUTO NOTE-DO NOT USE IN RS232 OR AUTO
CODE= 180	EXECUTE AUTO SELECTION 10	NOTE-DO NOT USE IN RS232 OR AUTO
CODE= 181	NO SELECTION	
CODE= 182	FIXED TEMP +UP	
CODE= 183	FIXED TEMP AT 30 DEGREES C	
CODE= 184	FIXED TEMP AT 35 DEGREES C	
CODE= 185	FIXED TEMP AT 37 DEGREES C	
CODE= 186	FIXED TEMP AT 38 DEGREES C	
CODE= 187	FIXED TEMP AT 40 DEGREES C	
CODE= 188	NO SELECTION	
CODE= 189	PACED RYTHM	
CODE= 190	PACED RYTHM FREQUENT SINUS	
CODE= 191	PACED RYTHM OCCASIONAL SINUS	
CODE= 192	ATRIAL VENTRICULAR SEQUENTIAL PACING	
CODE= 193	PACED RYTHM WITH NON CAPTURE*	
CODE= 194	NON FUNCTION PACED RYTHM	
CODE= 195	NO SELECTION	
CODE= 196	POSITIVE PACED PULSE IN LEAD II	
CODE= 197	NEGATIVE PACED PULSE IN LEAD II	
CODE= 198	NO SELECTION	
CODE= 199	PACER PULSE AMPLITUDE +UP	
CODE= 200	PACER PULSE AMPLITUDE -DOWN	
CODE= 201	PACER PULSE AT +/- 2MV	
CODE= 202	PACER PULSE AT +/- 4MV	
CODE= 203	PACER PULSE AT +/- 8MV	
CODE= 204	PACER PULSE AT +/- 10MV	
CODE= 205	PACER PULSE AT +/- 20MV	
CODE= 206	PACER PULSE AT +/- 50MV	
CODE= 207	PACER PULSE AT +/- 100MV	
CODE= 208	NO SELECTION	
CODE= 209	PACER PULSE DURATION +UP	
CODE= 210	PACER PULSE DURATION AT 0.1MSEC	
CODE= 211	PACER PULSE DURATION AT 0.2MSEC	
CODE= 212	PACER PULSE DURATION AT 0.5MSEC	
CODE= 213	PACER PULSE DURATION AT 1MSEC	
CODE= 214	PACER PULSE DURATION AT 2MSEC	
CODE= 215	NO SELECTION	
CODE= 216	PERFORMANCE WAVE SQUARE AT 2HZ	
CODE= 217	PERFORMANCE WAVE SQUARE AT 0.125HZ	
CODE= 218	PERFORMANCE WAVE PULSE AT 60BPM , 80MSEC WIDTH	
CODE= 219	PERFORMANCE WAVE TRIANGLE AT 2HZ	
CODE= 220	NO SELECTION	
CODE= 221	SINE WAVE FREQUENCY +UP	
CODE= 222	SINE WAVE AT 0.5HZ	
CODE= 223	SINE WAVE AT 1HZ	
CODE= 224	SINE WAVE AT 10HZ	
CODE= 225	SINE WAVE AT 40HZ	
CODE= 226	SINE WAVE AT 50HZ	
CODE= 227	SINE WAVE AT 60HZ	
CODE= 228	SINE WAVE AT 100HZ	

## MPS-2 OPERATING MANUAL

CODE= 229	NO SELECTION
CODE= 230	RESP RATE +UP
CODE= 231	RESP RATE -DOWN
CODE= 232	RESP RATE AT 0 BREATHS/MIN
CODE= 233	RESP RATE AT 15 BREATHS/MIN
CODE= 234	RESP RATE AT 20 BREATHS/MIN
CODE= 235	RESP RATE AT 30 BREATHS/MIN
CODE= 236	RESP RATE AT 40 BREATHS/MIN
CODE= 237	RESP RATE AT 60 BREATHS/MIN
CODE= 238	RESP RATE AT 80 BREATHS/MIN
CODE= 239	RESP RATE AT 100 BREATHS/MIN
CODE= 240	RESP RATE AT 120 BREATHS/MIN
CODE= 241	NO SELECTION
CODE= 242	RESP APNEA SET TO 12 SECONDS
CODE= 243	RESP APNEA SET TO 22 SECONDS
CODE= 244	RESP APNEA SET TO 32 SECONDS
CODE= 245	RESP APNEA CONTINUOUS
CODE= 246	APNEA OFF, BACK TO PREVIOUS RESP RATE SELECTION
CODE= 247	RESP DELTA +UP
CODE= 248	RESP DELTA 0 OHMS
CODE= 249	RESP DELTA 0.2 OHMS
CODE= 250	RESP DELTA 0.5 OHMS
CODE= 251	RESP DELTA 1 OHMS
CODE= 252	RESP DELTA 2 OHMS
CODE= 253	RESP DELTA 3 OHMS
CODE= 254	RESP LEAD SET TO I
CODE= 255	RESP LEAD SET TO II
CODE= 256	NO SELECTION
CODE= 257	BASELINE + UP
CODE= 258	ECG BASELINE AT 500 OHMS
CODE= 259	ECG BASELINE AT 1000 OHMS
CODE= 260	ECG BASELINE AT 1500 OHMS
CODE= 261	ECG BASELINE AT 2000 OHMS
CODE= 262	NO SELECTION
CODE= 263	SET CONTRAST DARKER
CODE= 264	SET CONTRAST LIGHTER
CODE= 265	BACKGROUND LIGHT
CODE= 266	BACKGROUND DARK
CODE= 267	BEEP OFF
CODE= 268	BEEP ON
CODE= 269	BEEP TEST
CODE= 270	BACKLIGHT OFF ALWAYS
CODE= 271	BACKLIGHT ON 5 SECS DURATION
CODE= 272	BACKLIGHT ON 8 SECS DURATION
CODE= 273	BACKLIGHT ON 10 SECS DURATION
CODE= 274	NO SELECTION
CODE= 275	NO SELECTION
CODE= 276	PACER CAL ROUTINE PACE PULSE EVERY 100 MSEC AT 20MV
CODE= 277	DO NOT USE
CODE= 278	DO NOT USE
CODE= 279	DO NOT USE

## MPS-2 OPERATING MANUAL

CODE= 280	DO NOT USE
CODE= 281	TEST RESP DELTA AT THE HIGH END
CODE= 282	TEST RESP DELTA AT THE LOW END
CODE= 283	DO NOT USE
CODE= 284	DO NOT USE
CODE= 285	DO NOT USE
CODE= 286	DO NOT USE
CODE= 287	DO NOT USE
CODE= 288	DO NOT USE
CODE= 289	DO NOT USE
CODE= 290	DO NOT USE
CODE= 291	DO NOT USE
CODE= 292	DO NOT USE
CODE= 293	DO NOT USE
CODE= 294	DO NOT USE
CODE= 295	NO SELECTION
CODE= 296	SAVE CURRENT SETTINGS FOR POWER ON
CODE= 297	NO SELECTION
CODE= 298	VIEW CURRENT SETTINGS
CODE= CODES FROM 299 TO 510 WILL SELECT NOTHING	
CODE= 511	BEEP TEST

Numbers between 1 - 511 which are not listed are reserved for later use.



## Appendix B - Accessories

### Standard Accessories:

- 3310-004: 9 Volt Alkaline Battery
- 6100-480: Operating Manual
- 3140-429: RJ-12 communication cable
- 3140-426: RJ-12 to DB-9 adapter

### Optional Accessories:

#### AC Adapters:

- 3000-445: North America/Japan
- 3000-446: Euro-Schuko/China
- 3000-447: UK

### Temperature Cables:

- 7200-454: YSI-400, unterminated
- 7200-455: YSI-700, unterminated
- 7200-530: YSI-400, Philips/HP

### Invasive Blood Pressure Cables:

- 7200-462: CRITICARE/CRITICON, 6 PIN
- 7200-463: DATASCOPE, 6 SOCKET
- 7200-464: DATEX-OHMEDA, 10 SOCKET
- 7200-465: DRAEGER/SIEMENS, 10 PIN
- 7200-466: GE/MARQUETTE, 11 PIN
- 7200-467: HP, 5 SOCKET
- 7200-468: HP/INVIVO/MDE, 6 PIN
- 7200-469: HP/PHILIPS, 12 PIN
- 7200-470: MARQUETTE, 7 PIN
- 7200-471: NIHON KHODEN, 5 PIN
- 7200-472: SPACELABS, 6 PIN
- 7200-477: FUKUDA DENSHI, 12 PIN

Check the Datrend website ([www.datrend.com](http://www.datrend.com)) for additions to this list.

