



DATREND  
Systems Inc.

# AMPS-1

*Advanced Modular Patient Simulator*

Operating Manual



# AMPS-1

## *Advanced Modular Patient Simulator*

### Operating Manual

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Revision	Revision History Description	Date
D	Update Address	2014-Dec-09
E	Update Appendix B	2016-May-17
F	Clarify Temperature Channels	2021-Jan-28

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Our routine method of shipment is via common carrier. Upon delivery, if physical damage is found, retain all packing materials in their original condition and contact the carrier immediately to file a claim. If the instrument is delivered in good physical condition but does not operate within specifications, or if there are any other problems not caused by shipping damage, please contact your local sales representative or Datrend Systems immediately.

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#### Refunds & Credits

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### Certification

This instrument was thoroughly tested and inspected and found to meet DSI's manufacturing specifications when it was shipped from the factory. Calibration measurements are traceable to the National Research Council of Canada (NRC) and/or the National Institute of Standards and Technology (NIST). Devices for which there are no NRC/NIST calibration standards are measured against in-house performance standards using accepted test procedures.

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## Warranty

### Warranty and Product Support

Datrend Systems Inc. ("DSI") warrants this instrument to be free from defects in materials and workmanship under normal use and service for one (1) year from the date of original purchase. This warranty will be automatically extended on a yearly basis, to a **maximum of five (5) years** from the date of original purchase, provided that calibration is performed on an **annual** basis by a Datrend Authorized Service Center. During the warranty period DSI will, at our option, either repair or replace defects in materials and workmanship at no charge; provided the product is returned (shipping, duty, brokerage and taxes prepaid) to DSI. Any and all transportation charges incurred are the responsibility of the purchaser and are not included within this warranty. This warranty extends only to the original purchaser and does not cover damage from abuse, neglect, accident or misuse or as the result of service or modification by other than DSI. **IN NO EVENT SHALL DATREND SYSTEMS INC. BE LIABLE FOR CONSEQUENTIAL DAMAGES.**

This warranty is subject to the following limitations:

- Re-calibration of the instrument, which has a recommended annual calibration frequency, is not covered under the warranty.

No warranty shall apply when damage is caused by any of the following:

- Misuse or abuse of any form;
- Discharge of a defibrillator or transcutaneous pacemaker into any terminal, interface connection or port not intended for that specific use;
- 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.

This warranty gives you specific legal rights and you may have other rights, which vary from province to province, state to state, or country to country. This warranty is limited to repairing the instrument to DSI's specifications.

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.
- Use heavy paper or cardboard to protect all instrument surfaces. Use nonabrasive material around all projecting parts.
- Use at least four inches of tightly packed, industrial-approved, shock-absorbent material all around the instrument.

DSI will not be responsible for lost shipments or instruments received in damaged condition due to improper packaging or handling. All warranty claim shipments must be made on a prepaid basis (freight, duty, brokerage, and taxes). No returns will be accepted without a Return Materials Authorization ("RMA") number. Please contact Datrend Systems, 1(604)291-7747 or email [customerservice@datrend.com](mailto:customerservice@datrend.com) to obtain a Return Materials Authorization (RMA) number and receive help with shipping/customs documentation.

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**Warranty Disclaimer**

Should you elect to have your instrument serviced and/or calibrated by someone other than Datrend Systems, please be advised that the original warranty covering your product becomes void when the tamper-resistant Quality Seal is removed or broken without proper factory authorization. We strongly recommend, therefore, that you send your instrument to Datrend Systems for service and calibration, especially during the original warranty period. In all cases, breaking the tamper-resistant Quality Seal should be avoided at all cost, as this seal is the key to your original instrument warranty. In the event that the seal must be broken to gain internal access to the instrument (e.g., in the case of a customer-installed firmware upgrade), you must first contact Datrend Systems. You will be required to provide us with the serial number for your instrument as well as a valid reason for breaking the Quality Seal. You should break this seal only after you have received factory authorization. Do not break the Quality Seal before you have contacted us! Following these steps will help ensure that you will retain the original warranty on your instrument without interruption.

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## **Abbreviations, Definitions and Symbols**





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

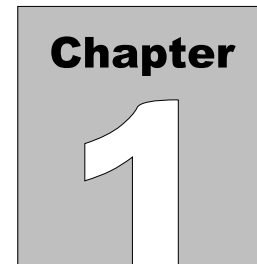
°C	degrees Celsius (centigrade)
°F	degrees Fahrenheit
AED	Automated External Defibrillator
AHA	American Heart Association
Arrhythmia	An abnormal rhythm of the cardiac muscle; an abnormal pattern or rate of heart beats.
Autosequence	A series of measurements or test operations that are run automatically 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	kilohm
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

## AMPS-1 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)
	In ALPHA mode, enters the menu indicated on button face. In NUMERIC mode, inputting numbers via the keypad and pressing the ENTER button will activate the desired function, parameter or setting.

## **AMPS-1 OPERATING MANUAL**



# 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 – 4: proprietary USB
- TEMP: 6-pin mini-DIN
- AUX: 8-pin mini-DIN
- High-level ECG Out / Defib Trigger In: 2.5mm stereo phono jack
- DC IN: EIAJ-3, center-positive (9 VDC, 500 mA)
- RS-232 Serial Port: proprietary RJ-12

### User Interface:

AMPS-1 is controlled through 17 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.

## AMPS-1 OPERATING MANUAL

### Display:

20 character by 2 line alphanumeric LCD

### Dimensions and Weight:

- 10 x 19 x 3 cm (4" x 7<sup>3</sup>/<sub>8</sub>" x 1<sup>1</sup>/<sub>4</sub>")
- 0.34 kg (12 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): 0.1, 0.25, 0.5, 1, 2, 3, 4 and 5 mV - normal amplitude settings  
0.05 to 5.50 mV in 0.05 mV steps - using performance 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
- Axis Deviation: Normal (intermediate), horizontal, and vertical. Modifies ECG baseline during arrhythmias.
- Neonatal Mode: ECG R-wave width is reduced to 40 milliseconds



## AMPS-1 OPERATING MANUAL

### Arrhythmia:

#### GENERAL 1

- Asystole 1
- Asystole 2
- Asystole 3
- 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
- Second Degree TYPE 2
- 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

#### GENERAL 2

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

## AMPS-1 OPERATING MANUAL

### AED/Shock Advisory:

- Ventricular Rhythm @ 90 BPM
- Ventricular Rhythm @ 120 BPM
- Ventricular Tachycardia @ 140 BPM
- Ventricular Tachycardia @ 160 BPM
- Ventricular Tachycardia @ 180 BPM
- Ventricular Tachycardia @ 190 BPM
- Emergency 1
- Emergency 2
- Elective Cardioversion
- Defib NOW
- Defib R SYNC

### ECG Performance Tests:

- Square Waves: 2 Hz, 0.125 Hz
- Triangle Wave: 2 Hz
- Pulse: 80 msec, 1 Hz (60 BPM) ; 4 sec, 0.125 Hz
- Sine Waves: 0.05, 0.5, 1, 10, 25, 30, 40, 50, 60, and 100 Hz
- R-Wave Detector Test: 60 BPM haver-triangle wave with selectable width
- Haver-triangle Width: 8, 12, 20, 40, 60, 80, 100, 120, 140, 160, 180 and 200 msec
- Performance Amplitude: 0.05 to 5.50 mV in 0.05 mV steps  
(applies to all performance waveforms)

### 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, 0.05, 0.1, 0.2, 0.5, 1, 2, 3, 4 and 5 ohms
- Simulation Types: Inspiration:Expiration ratios of 5:1, 4:1, 3:1, 2:1, and 1:1, and Ventilator simulation

## AMPS-1 OPERATING MANUAL

### Temperature:

- 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, 200, 500 and 700 mV
- Pacer Pulse Width: 0.1, 0.2, 0.5, 1.0, and 2.0 msec
- Pacer Pulse Polarity: Positive or negative

### Invasive Blood Pressure (OPTIONAL):

- Channels: 2 or 4 functionally identical channels
- Electrical Isolation: Isolates BP channels from other AMPS-1 connections (ECG, temperature, respiration)
- Static Pressures: -10, -5, 0, 20, 40, 60, 80, 100, 120, 150, 160, 180, 200, 240, 320 and 400 mmHg
- Transducer Sensitivity: 5  $\mu$ V/V/mmHg or 40  $\mu$ V/V/mmHg
- Dynamic Simulations:
  - Arterial 120/80, 90/40, and 160/100
  - 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

## AMPS-1 OPERATING MANUAL

### Cardiac Output (OPTIONAL):

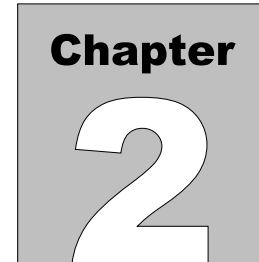
- Baseline Temperatures: 36, 37 and 38°C.
- Injectate Thermistor Types:
  - H-P/Philips compatible, at 2°C or 20°C
  - American Edwards/Spacelabs compatible, at 2°C
  - Adjustable (default Edwards/Spacelabs at 20°C)
- Injectate Temperatures: 2 or 20°C.
  - Cardiac Outputs: 3, 4, 4.5, 5, 5.5, 6, 6.5 and 7 liters/minute
  - Simulation Types:
    - Trend On/Off
    - Slow/Faulty Injection
    - L/R Shunt
    - Cal Pulse: 1°C for 1 second
    - Cal Pulse: 1°C for 4 seconds

### Fetal ECG/Intrauterine Pressure (OPTIONAL):

- Fetal ECG Base Rates: 60, 90, 120, 140, 150, 180, 210, and 240 BPM
- Fetal ECG Amplitudes: 0.1, 0.25, 0.5, 1, 2, 3, 4 and 5 mV
- Fetal ECG Rate Variation: Uniform, early, and late deceleration
  - Intrauterine Pressure: 0-25, 0-50 and 0-100 mmHg
- Transducer Sensitivity: 5  $\mu\text{V/V/mmHg}$  or 40  $\mu\text{V/V/mmHg}$

### Auto Presets:

Ten user-defined simulation setups can be programmed and uploaded to AMPS-1 using the *AMPSpc* software (standard accessory, included).



## 2 General Information

### 2.1 Overview

AMPS-1, the Advanced Modular Patient Simulator, is a comprehensive simulation platform designed to expedite and simplify the testing of all patient monitoring devices.

The wide range of simulations available for ECG, artifacts, arrhythmia conditions, performance tests, respiration, pacemaker, body temperature, defibrillator training, optional blood pressure, optional cardiac output, and optional fetal ECG with intrauterine pressure make AMPS-1 the most comprehensive multi-parameter simulator available.

### 2.2 Features

The compact and portable AMPS-1 measures just 10 x 19 x 3 cm (4" x 7<sup>3</sup>/<sub>8</sub>" x 1<sup>1</sup>/<sub>4</sub>"), weighs less than 350 grams (12 ounces), and operates for approximately 20 hours continuous use when powered by a single 9 Volt alkaline battery.

AMPS-1 is controlled through 17 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.

AMPS-1 includes an RS-232 communications port to allow control through serial commands. This allows AMPS-1 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 the included *AMPSpc* companion software application.

A unique feature of AMPS-1 allows the user to enable specific features or module options (such as Invasive Blood Pressures, Cardiac Output, etc.) after the unit is in the field. There is no need to return AMPS-1 to the factory to enable optional modules.

### 2.3 Main Functions of AMPS-1

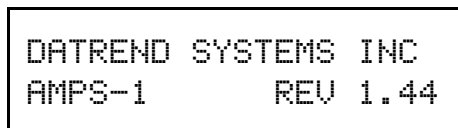
- Normal Sinus Rhythm
- Arrhythmia Waveforms, including premature beats; conduction defects; supraventricular beats; ventricular rhythm and tachycardia; fibrillation; etc.
- ECG Performance Waveforms
- AED Test Waveforms
- Defibrillator Training Waveforms
- Pacemaker Waveforms
- Fetal ECG Waveforms
-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

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

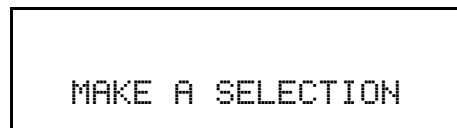
### 2.4 Powering up AMPS-1

To power up, press the POWER button on the left side of AMPS-1.

The Power-On screen (**Figure 1**), which shows the firmware version number, will appear briefly and then be replaced by the Selection screen (**Figure 2**).



**Figure 1-** POWER ON Screen



**Figure 2-** SELECTION Screen

When viewing the Selection screen, pressing any of the keys 0 - 9 will enter a menu for the simulation function(s) noted on the button face. Each simulation function is described in a separate Chapter of this manual.

ECG, respiration, temperature, and other simulation parameters are automatically initialized to default values when AMPS-1 is powered up. These settings are the "Power-On" defaults for AMPS-1. As described in Section 13.3, up to twenty AMPS-1 parameters can be programmed by the user to configure the default multi-parameter patient simulation which takes effect at power-on.

### 2.5 ALPHA and NUMERIC Modes

Pressing the SHIFT key while viewing any AMPS-1 menu will toggle between ALPHA and NUMERIC operating modes.

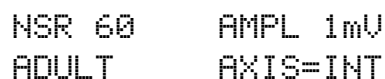
At power-on, AMPS-1 defaults to operating in ALPHA mode. In this mode, each keypad button (ECG; ARRY; RESP; and so on) enters a menu corresponding to the label on the button face. The scroll keys (◀; ▶; ▲; ▼) are then used to navigate the selected menu. When a desired setting is shown on the LCD display, the ENTER button is pressed to activate the setting.

In NUMERIC mode, code numbers can be input via the AMPS-1 keypad 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

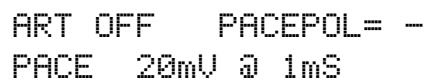
A wide range of simulation parameters are automatically initialized to default values when AMPS-1 is powered up. These settings are the "Power-On" defaults for AMPS-1.

Immediately after applying power to AMPS-1, pressing the VIEW/SAVE button repeatedly will scroll through the current settings for the "Power-On" defaults, as shown in **Figure 3** through **Figure 9** inclusive.



```
NSR 60      AMPL 1mV
ADULT       AXIS=INT
```

Figure 3- POWER ON #1: ECG defaults



```
ART OFF     FACEPOL= -
PACE 20mV @ 1mS
```

Figure 4- POWER ON #2: ECG/PACER defaults

## AMPS-1 OPERATING MANUAL

```
DELT=5Ω    RESP=20BM  
I/E 2/1    BASE 1000Ω
```

Figure 5- POWER ON #3: RESP defaults

```
BP CHAN1    =    0 mm  
BP CHAN2    =    0 mm
```

Figure 6- POWER ON #4: BP1+2 defaults

```
BP CHAN3    =    0 mm  
BP CHAN4    =    0 mm
```

Figure 7- POWER ON #5: BP3+4 defaults

```
BPSEN  5uV  BPART OFF  
TEMP=37°C
```

Figure 8- POWER ON #6: BP/TEMP defaults

```
INJ= T3    INJ= 02°C  
CAL= ON    BASE= 37°C
```

Figure 9- POWER ON #7: CO defaults



At power-up, AMPS-1 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 default dynamic BP simulations by pressing **SHIFT-3-ENTER** on the AMPS-1 keypad.

There are three methods to change power-on default settings: ALPHA mode; NUMERIC mode; and via the *AMPSpc* software as described below.



## AMPS-1 OPERATING MANUAL

### 2.6.1 Alpha Mode

Press the desired keypad button to open the corresponding menu.

Using the Arrow buttons (◀; ▶; ▲; ▼), 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)
ECG-ADV	AXIS, NEONATAL (on/off)
BP1-4	DYNAMIC 1 (simulation)
BP-ADV	DEFAULT (sensitivity)
RESP	RATE, IMPEDANCE, DELTA, RATIO
PACER	AMPL, WIDTH, POS/NEG (positive/negative)
TEMP	TEMPERATURE
CO	BASE (baseline temperature), TEMP (injectate temperature), INJT (injectate thermistor type)

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 SHIFT, then press VIEW/SAVE to store the settings as the power-on defaults in AMPS-1 memory.

### 2.6.2 Numeric Mode

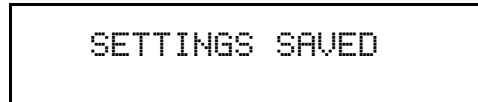
After powering up AMPS-1, simulator operation will default to ALPHA mode. To switch to NUMERIC mode, press the SHIFT key.

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 1, 2 or 3 digits via the keypad and press ENTER. To change another power-on setting in NUMERIC mode, repeat these steps, pressing ENTER after each selection is made.

## AMPS-1 OPERATING MANUAL

When you are finished changing settings or selections, press VIEW/SAVE.

After power-on defaults are saved, the LCD display will appear as shown in **Figure 10**, and AMPS-1 will remain in NUMERIC mode. Press SHIFT to switch from NUMERIC to ALPHA mode.



**Figure 10-** SETTINGS SAVED

### 2.6.3 AMPSpC

*AMPSpC* companion software, supplied on CD ROM as a standard accessory with AMPS-1, allows you to program the power-on default settings using drop-down boxes. Simply make the desired selections, connect AMPS-1 to your PC using the RS-232 serial cable provided, and upload to AMPS-1.

See Chapter 13 for more information on *AMPSpC*.

## AMPS-1 OPERATING MANUAL

### 2.7 Connecting to AMPS-1

As shown in **Figure 11**, the top side of AMPS-1 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.

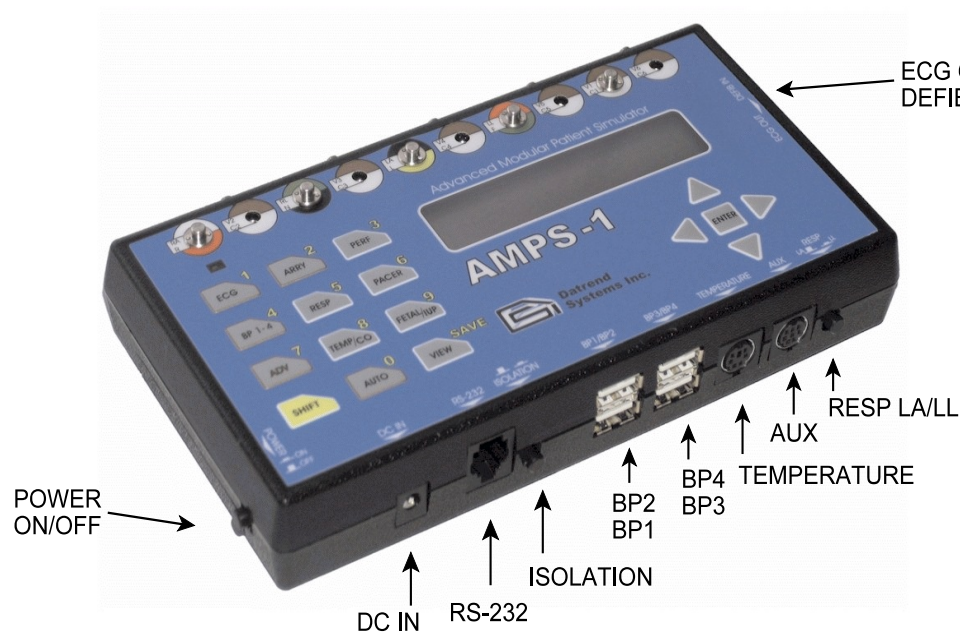


Figure 11 - AMPS-1 Interface

The front/bottom panel of AMPS-1 provides connections for DC Power in, bi-directional RS-232 communication, 4 Invasive Blood Pressures, Cardiac Output (AUX), and Temperature. A pushbutton to toggle respiration output (LA or LL), referenced to RL, is also located along this panel.

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

A stereo phono jack located on the right side of AMPS-1 provides a high-level ECG output on the tip connection. The ring connection of the stereo jack provides an input for receiving an externally-generated trigger signal of 2.5 to 5 volts. This trigger signal, which is meant to represent the discharge of a defibrillator, is monitored by AMPS-1 during defibrillator training simulations and causes the ECG waveform to change in response to the trigger.

### 2.8 Navigating AMPS-1 Menus

The menus of AMPS-1 have been arranged to minimize, as much as possible, the keystrokes needed to select a particular setting.

The main keys on the keyboard (0 - 9) are associated with a high level function, for example, ECG, RESP, PACER and so on. Each time a function key is pressed, you are taken to a menu which allows you to change the simulation settings for that function.

The upper line 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 on the right side of AMPS-1, under the LCD, allow you to scroll through the available parameters. UP (▲) and DOWN (▼) arrow keys 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.

ECG, arrhythmia (ARRY) and blood pressure (BP) simulations have additional parameters which are set less frequently. To streamline operation of AMPS-1, these particular parameters are segregated in an "Advanced" group under the ADV (7) key. "Advanced" parameters are accessed by pressing the ADV (7) key while in any function that provides "Advanced" parameters. These functions, and the ADV key, have a copper-colored border around the key to indicate "Advanced" settings are provided.

For example, to access the "Advanced" settings for ECG, press the ECG key, followed by ADV. Parameters provided by the "Advanced" menu for ECG include ST DEPR (ST segment depression/elevation); AXIS; and NEONATAL (on or off).



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.

With AMPS-1 in ALPHA mode, repeatedly pressing the VIEW button scrolls the display through a number of screens which list the current settings for selected parameters, for example, ECG rate and amplitude, pacemaker setup, respiration setup, blood pressure and so on. If VIEW is pressed immediately after power-up of AMPS-1, the power-on default settings of the simulator will then be displayed, as previously described.

## **3 ECG Normal Sinus Rhythm**

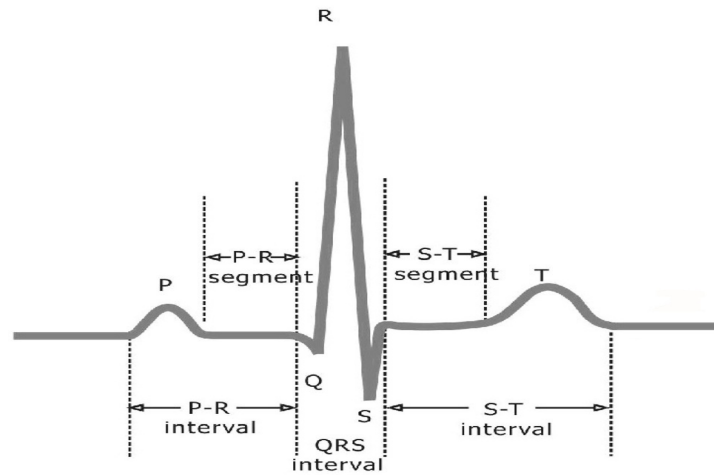
### **3.1 Overview**

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.

AMPS-1 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. 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 12 - 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)**

- 0.1, 0.25, 0.5, 1, 2, 3, 4 and 5 mV - using normal settings
- 0.05 to 5.50 mV in 0.05 mV steps - using performance settings

#### **3.3.3 Baseline (Electrode) Impedance**

- 500, 1000, 1500 and 2000 $\Omega$ .

#### **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 Axis Deviation**

- Normal (intermediate), horizontal, and vertical. Modifies ECG baseline during arrhythmias.

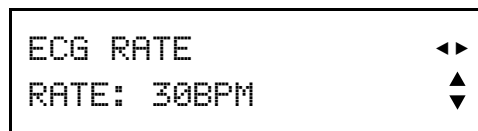
#### **3.3.7 Neonatal Mode**

- 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 ECG(1) button to change the LCD display to that of **Figure 13**, the ECG Rate Menu.

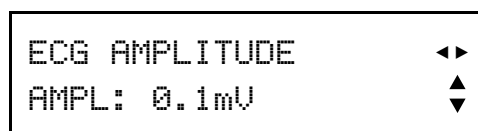


**Figure 13- ECG RATE**

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 green LED above the ECG button, or through an ECG monitor if such a monitor is connected.

While viewing the display of **Figure 13**, pressing the RIGHT (▶) arrow button once will change the display to that of **Figure 14**, the ECG Amplitude Menu.



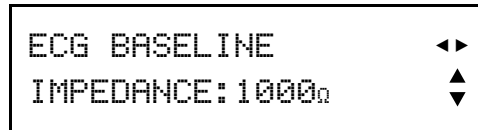
**Figure 14- ECG AMPLITUDE**

Press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided for the ECG amplitude: 0.1, 0.25, 0.5, 1, 2, 3, 4 and 5mV. If finer control of the amplitude is desired, go to the PERFormance AMPLitude setting and select from 0.05 to 5.50 mV in 0.05 mV steps. This amplitude setting will remain in effect in the ECG setting until another AMPLitude is selected.

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

## AMPS-1 OPERATING MANUAL

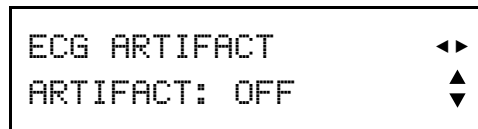
Pressing the RIGHT (▶) arrow button will change the screen to that of **Figure 15**, the Baseline Impedance Menu.



**Figure 15- ECG BASELINE IMPEDANCE**

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 (▶) an arrow button will change the screen to **Figure 16**, the ECG Artifact Menu.



**Figure 16- ECG ARTIFACT**

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 initial menu screen of **Figure 13**.

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.



### 3.5 ECG Advanced Function

There are several additional parameters associated with the ECG simulation which may be used less frequently. These parameters (ECG ST, ECG AXIS and ECG NEONATAL) are available via the ADV(7) button.

Pressing the ADV(7) button while viewing the ECG menu will change the screen to that of **Figure 17**, the ST Segment Menu. To return to the Normal ECG menu, press the ECG(1) button and the screen will return to that of **Figure 13**.

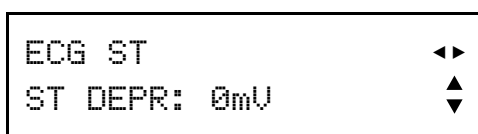


Figure 17- ECG ADVANCED: ST SEGMENT

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 17**, 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 screen to that of **Figure 18**, the ECG Axis Menu.

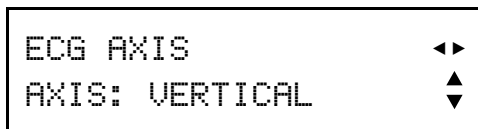
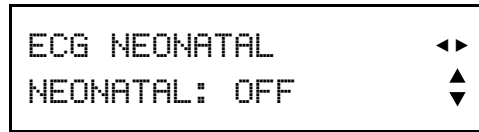


Figure 18- ECG ADVANCED: AXIS

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for ECG axis: NORMAL (INTERMEDIATE), HORIZONTAL, and VERTICAL.

## AMPS-1 OPERATING MANUAL

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



**Figure 19-** ECG ADVANCED: NEONATAL

Press the UP (▲) or DOWN(▼) arrow button to toggle the NEONATAL simulation between OFF and ON. When set to "ON", the duration of the ECG R-wave is reduced to 40 milliseconds.

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 simulator parameters in reverse order.

Press ENTER after selecting a parameter to activate your selection.

## **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.

AMPS-1 offers a wide range of arrhythmia simulations to test the function of patient monitors. AMPS-1 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
- Asystole 2: low activity, peak amplitude < 0.15mV
- Asystole 3: high activity, peak amplitude > 0.15mV

## **AMPS-1 OPERATING MANUAL**

### **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 Second Degree Heart Block, Type 2**

- A waveform similar to right bundle branch block except PR interval is 0.25 seconds: eighteen beats at 80 BPM followed by two missed beats.

### **4.2.12 Third Degree Heart Block**

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

### **4.2.13 Right Bundle Branch Block**

- PR interval of 0.16 seconds

### **4.2.14 Left Bundle Branch Block**

- PR interval of 0.16 seconds

## **AMPS-1 OPERATING MANUAL**

### **4.2.15 Fibrillation**

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

### **4.2.16 Paroxysmal Atrial Tachycardia**

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

### **4.2.17 Supraventricular Tachycardia**

- Normal sinus rhythm, but at 160 BPM

### **4.2.18 Atrial Flutter**

### **4.2.19 Sinus Arrhythmia**

- Varying rate, 60 to 100 BPM

### **4.2.20 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

### **4.2.21 Nodal Rhythm**

### **4.2.22 AED/Shock Advisory**

- Ventricular Rhythm @ 90 and 120 BPM
- Ventricular Tachycardia @ 140, 160, 180 and 190 BPM

### **4.2.23 Defibrillator Training**

- Emergency scenarios 1 and 2
- Elective cardioversion
- Defibrillator discharge simulations:
  - a. NOW (unsynchronized to ECG);
  - b. R SYNC (synchronized to ECG R-wave); or
  - c. In response to an external trigger signal applied at the DEFIB IN jack

## 4.3 Arrhythmia Function

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

Press the ARRY(2) button and the LCD display will change to that of **Figure 20**, the ARRHYTHMIA main menu.

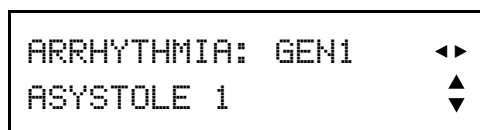


Figure 20- ARRHYTHMIA: "GEN1" Group

Press the UP (▲) or DOWN (▼) arrow button to scroll through the arrhythmia waveforms provided under "GENERAL" group #1: ASYSTOLE 1, ASYSTOLE 2, ASYSTOLE 3, 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 21**.

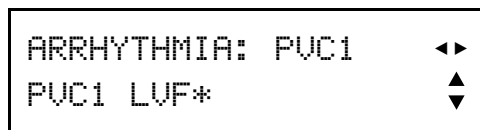


Figure 21- ARRHYTHMIA: "PVC1" Group

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 menus of **Figure 21** and **Figure 22** 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 22**.

## AMPS-1 OPERATING MANUAL

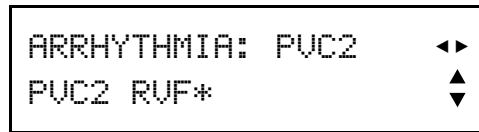


Figure 22- ARRHYTHMIA: "PVC2" Group

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 23**.

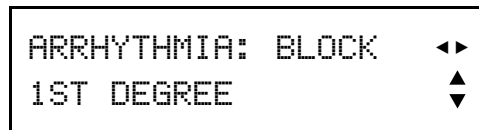


Figure 23- ARRHYTHMIA: "BLOCK" Group

Press the UP (▲) or DOWN(▼) arrow button to scroll through the arrhythmia waveforms provided under the conduction block group: 1ST DEGREE, 2ND DEGREE TYPE1, 2ND DEGREE TYPE2, 3RD DEGREE, RIGHT BUNDLE, and LEFT BUNDLE.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 24**.

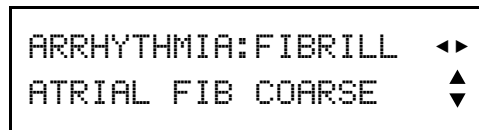


Figure 24- ARRHYTHMIA: "FIBRILL" Group

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 25**.

## AMPS-1 OPERATING MANUAL

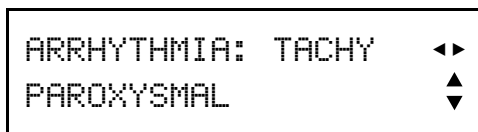


Figure 25- ARRHYTHMIA: "TACHY" Group

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

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 26**.

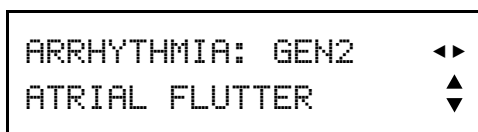


Figure 26- ARRHYTHMIA: "GEN2" Group

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 change the menu screen to that of **Figure 27**.

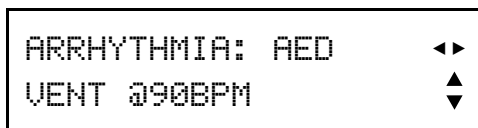


Figure 27- ARRHYTHMIA: "AED" Group

Press the UP (▲) or DOWN(▼) arrow button to scroll through the arrhythmia waveforms provided under the AED group: VENT @90BPM, VENT@120BPM, VTACH @140BPM, VTACH @160BPM, VTACH@180BPM, VTACH@190BPM, EMERGENCY 1, EMERGENCY 2, and ELECTIVE CARDIOVER. Additionally, two settings are provided in this group which simulate the delivery of a defibrillator discharge: DEFIB NOW and DEFIB R-SYNC.

Pressing the RIGHT (▶) arrow button will restore the LCD display to the initial menu screen of **Figure 20**.

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.



### 4.4 Defibrillator Training

#### 4.4.1 Overview

The arrhythmia/AED menu provides interactive simulations in which AMPS-1 outputs a fibrillation waveform that can then be "defibrillated" by selecting either DEFIB NOW or DEFIB R-SYNC via the keypad. Alternatively, a defibrillator discharge can be simulated by applying an external trigger signal to AMPS-1 via the "DEFIB IN" jack.

#### 4.4.2 External Trigger Specifications

The trigger signal that may be applied to "DEFIB IN" of AMPS-1 is *not* a defibrillator discharge, but is simply a low-level pulse signal that represents a synchronization pulse from a defibrillator.

The trigger connects to *ring* (signal) and *sleeve* (ground) of the stereo "DEFIB IN" jack. The trigger amplitude may range from 2.5 to 5.0 volts and the duration of the pulse should be at least 5 milliseconds. Polarity of the trigger voltage may be positive or negative with respect to "DEFIB IN" ground (sleeve).

A suitable trigger signal can be obtained by connecting the "WAVEFORM OUTPUT" jack of the Datrend Phase 3 Defibrillator Analyzer to the "DEFIB IN" jack of AMPS-1 (tip connection at Phase 3, to ring connection at AMPS-1). Discharging a defibrillator into Phase 3 will result in a pulse of appropriate amplitude at the WAVEFORM OUTPUT, which will then trigger AMPS-1.

#### 4.4.3 Scenario Descriptions

With two emergency scenarios and a cardioversion scenario, AMPS-1 can be used for basic defibrillator training.

The "Emergency 1" scenario generates the following sequence of ECG rhythms:

- ten NSR beats at 80 BPM
- a PVC
- six NSR beats
- a second PVC
- continuous ventricular fibrillation thereafter, until "defibrillation" via AMPS-1 keypad or an external trigger signal at "DEFIB IN"

## AMPS-1 OPERATING MANUAL

The "Emergency 2" scenario generates this sequence of ECG rhythms:

- ten NSR beats at 80 BPM
- 25 beats of ventricular tachycardia at 180BPM
- continuous ventricular fibrillation thereafter, until "defibrillation" via AMPS-1 keypad or an external trigger signal at "DEFIB IN"

The "Elective Cardioversion" scenario of AMPS-1 produces an atrial fibrillation waveform (AFIB). For defibrillation to be effective, the "discharge" must be properly synchronized to the ECG R-wave. If a trigger pulse is detected by AMPS-1 and is within  $\pm 100$  milliseconds of the R-wave, defibrillation is successful and the ECG will then convert to a normal sinus rhythm. If a trigger pulse is detected more than  $\pm 100$  milliseconds from the R-wave, defibrillation is late and the ECG will then change to ventricular fibrillation.

### 4.4.4 Defibrillator Discharge Simulation

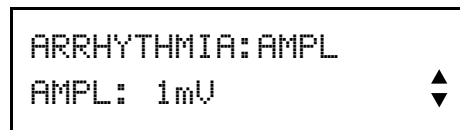
While simulating EMERGENCY 1, EMERGENCY 2, or ELECTIVE CARDIOVER, AMPS-1 will accept a trigger pulse applied via the "DEFIB IN" jack as previously described. In response to a trigger at the correct time, a large negative-going transient will then appear on the simulated ECG, followed by a gradual recovery of the baseline and a change in rhythm to NSR. The simulated ECG transient is always negative-going, regardless of the polarity of the trigger voltage applied at the "DEFIB IN" jack.

As an alternative to an external trigger signal, DEFIB NOW of the AED submenu may be selected after initiating the desired emergency or cardioversion simulation. For the cardioversion simulation, selecting DEFIB NOW will most likely change the ECG from AFIB to ventricular fibrillation, unless by remote chance the ENTER key is pressed in perfect synchronism with the ECG R-wave, in which case the ECG will change from AFIB to NSR.

Alternatively, DEFIB R SYNC can be selected after the elective cardioversion simulation has been initiated. In this case, AMPS-1 will delay the simulated discharge until the R-wave of the ECG occurs. Accordingly, DEFIB R SYNC provides an ideal illustration of a successful cardioversion.

## **4.5 Arrhythmia Advanced Function**

Pressing the ADV(7) button anytime while in ARRY mode will change the screen to that of **Figure 28**, the arrhythmia amplitude menu.



**Figure 28** - ARRHYTHMIA ADVANCED: AMPLITUDE

Press the UP (▲) or DOWN(▼) arrow button to scroll through the amplitude settings for the selected arrhythmia waveform: 0.1, 0.25, 0.5, 1, 2, 3, 4 and 5mV.

Press the ARRY button to return the LCD display to the initial menu screen of **Figure 20**.

## **AMPS-1 OPERATING MANUAL**

**Chapter**  
**5**

## **5 Performance Waveforms**

### **5.1 Overview**

AMPS-1 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**

- 0.05, 0.5, 1, 10, 25, 30, 40, 50, 60, and 100 Hz.

#### **5.2.5 R-Wave Detector Test**

- 60 BPM haver-triangle waveform
- Selectable widths: 8, 12, 20, 40, 60, 80, 100, 120, 140, 160, 180 and 200 msec

## AMPS-1 OPERATING MANUAL

### 5.2.6 Performance Amplitude

- Lead II, 0.05 to 5.50 mV in 0.05 mV steps
- Applies to the currently-selected performance waveform

## 5.3 ECG Performance Function

Parameters provided for the ECG performance function are: Square, Triangle and Pulse waveform; Sinusoidal waveform; Haver-triangle pulse width; and Amplitude.

Pressing the PERF (3) button will enter the Performance Waveform menu, as shown in **Figure 29**.

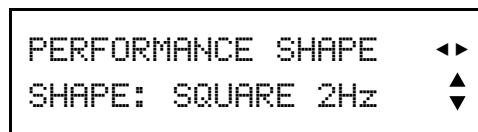


Figure 29- PERFORMANCE: WAVESHAPE

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 30**.

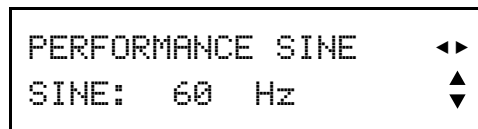


Figure 30- PERFORMANCE: SINEWAVE

Press the UP (▲) or DOWN (▼) arrow button to scroll through the frequencies provided for the sinusoidal waveform: 0.05, 0.5, 1, 10, 25, 30, 40, 50, 60 and 100 Hz.

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

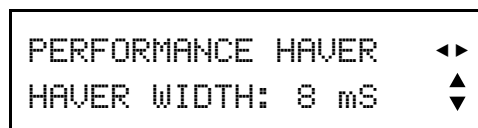
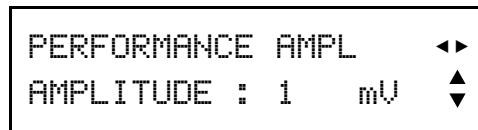


Figure 31- PERFORMANCE: HAVER WIDTH

## AMPS-1 OPERATING MANUAL

Press the UP (▲) or DOWN(▼) arrow button to scroll through the pulse widths provided for the Haver-triangle waveform: 8, 12, 20, 40, 60, 80, 100, 120, 140, 160, 180 and 200 milliseconds. This waveform can be used to test R-wave detection performance of a patient monitor.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 32**.



**Figure 32-** PERFORMANCE: AMPLITUDE

Press the UP (▲) or DOWN(▼) arrow button to scroll through the amplitudes provided for the selected performance waveform: 0.05, 0.10, 0.15, 0.20, 0.25, 0.30, 0.35, 0.40, 0.45, 0.5, 0.75, 1, 1.25, 1.50, 1.75, 2, 2.25, 2.50, 2.75, 3, 3.25, 3.50, 3.75, 4, 4.25, 4.50, 4.75, 5, 5.25 and 5.50 mV.

Pressing the RIGHT (▶) arrow button will restore the LCD display to the initial menu screen of **Figure 29**.

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.

## **AMPS-1 OPERATING MANUAL**



**Chapter**  
**6**

## 6 Invasive Blood Pressure (optional)

### 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).

AMPS-1 offers the option of two or four electrically isolated BP channels and simulates static pressures, as well as dynamic BP waveforms that track arrhythmia and normal sinus ECG simulations.



Figure 33 - IBP Connections

The unique isolation system of AMPS-1 was designed to provide true electrical isolation of the BP as well as the cardiac output channels.

## AMPS-1 OPERATING MANUAL

In the past, some patient monitors did not have isolation between their ECG and BP channels. With these early monitors, ECG, BP and other patient signals shared a common circuit ground. But when ECG and BP channels were connected to the same simulator, the signals could appear to fail required tests. However, isolation problems such as this are generally not an issue with the current generation of patient monitors.

In most cases, the ISOLATION button (located next to the RS-232 port on the bottom side of AMPS-1) should remain in the **OFF** (out) position. If there seems to be an interaction when ECG and BP signals of AMPS-1 are simultaneously connected to a monitor, press the ISOLATION button to the ON (in) position.



Note: since the ISOLATION function reduces battery life, it should *only be used when necessary*.

Respiration artifact can be selected on all BP channels; RESP ARTIFACT1 has an amplitude of 5 mmHg, and RESP ARTIFACT2 has an amplitude of 10 mmHg.

## 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
- Arterial 90/40
- Arterial 160/110
- 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

## AMPS-1 OPERATING MANUAL

### 6.2.4 Artifact

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

## 6.3 Blood Pressure Function (optional)

Note: BP1-4 are optional features and must be activated before they can be used.

Parameters provided for BP 1-4 are: Arterial; Ventricular; Left and Right Atrium; Pulmonary Artery and Wedge; automatic and manual Swan-Ganz simulations.

Pressing the BP 1-4 button will display the options for BP channel 1 as shown in **Figure 34**.

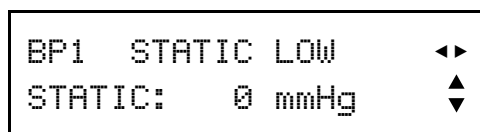


Figure 34- BLOOD PRESSURE

Pressing the BP 1-4 button repeatedly will cycle the display through the installed blood pressure channels.

While within the menu for any of the BP channels, any change in settings will only change that particular channel. The exception is changing a dynamic waveform to a static pressure level, which will change all channels to the same static pressure.

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

With AMPS-1 displaying the menu of **Figure 34**, 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 and 100 mmHg.

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

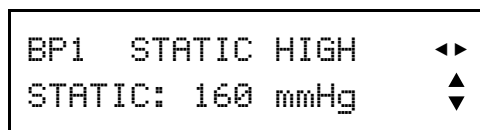


Figure 35- BP1 STATIC HIGH

## AMPS-1 OPERATING MANUAL

Press the UP (▲) or DOWN(▼) arrow button to scroll through the static levels provided for the high pressure range: 120, 150, 160, 180, 200, 240, 320 and 400 mmHg.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 36**.

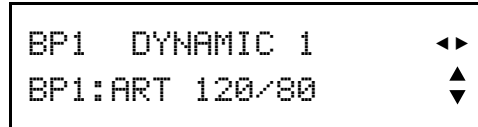


Figure 36- BP1 DYNAMIC Group 1

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, and RT VENT 25/0.

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

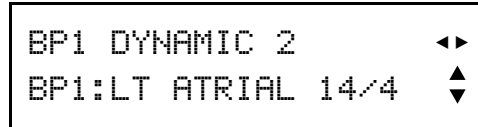


Figure 37- BP1 DYNAMIC Group 2

Press the UP (▲) or DOWN(▼) arrow button to scroll through the simulations of the DYNAMIC 2 group: LT ATRIAL 14/4, RT ATRIAL 15/10, PULM ART 25/10, and PULM W 10/2.

Pressing the RIGHT (▶) arrow button again will restore the LCD display to the initial menu screen of **Figure 34**.

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.

## 6.4 Blood Pressure Advanced Function

Parameters provided under "Advanced" BP are: Swan-Ganz; Sensitivity; and Default Sensitivity.

Pressing the ADV button while viewing any of the blood pressure menu screens will change the display to that of **Figure 38**. Note that for the BP-ADV menu, changes made to settings will only affect the BP channel indicated at the top left corner of the LCD display, for example, BP1 as shown in **Figure 38**. To change settings on a different BP channel, press the BP 1-4 button until the desired channel is displayed at top left on the LCD, then press the ADV key.

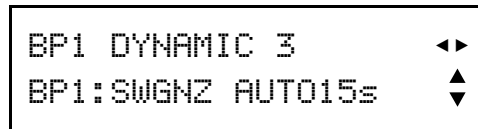


Figure 38 - BP1 DYNAMIC Group 3

Referring to **Figure 38**, press the UP (▲) or DOWN (▼) arrow button toggle the DYNAMIC 3 simulation between SWGNZ AUTO15s and SWGNZ MANUAL.

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

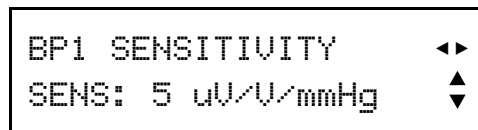


Figure 39- BP1 ADVANCED: SENSITIVITY

Press the UP (▲) or DOWN (▼) arrow button to toggle the transducer sensitivity between 5 and 40  $\mu\text{V/V/mmHg}$ .

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 40**.

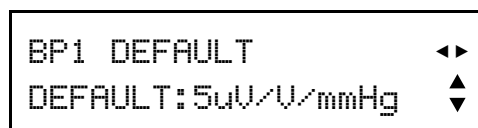
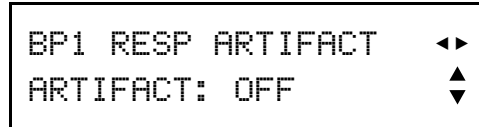


Figure 40- BP1 ADVANCED: DEFAULT

## AMPS-1 OPERATING MANUAL

Press the UP (▲) or DOWN(▼) arrow button to toggle the (power-on) default sensitivity between 5 and 40  $\mu\text{V}/\text{V}/\text{mmHg}$ .

Pressing the RIGHT (►) arrow button will change the menu screen to that of **Figure 41**.



**Figure 41-** BP1 ADVANCED: ARTIFACT

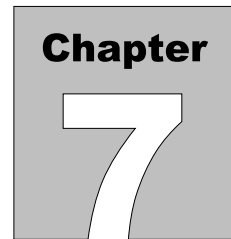
Press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided for the respiration artifact: OFF, 1-ON, and 2-ON.

Pressing the RIGHT (►) arrow button again will restore the LCD display to the initial menu screen of **Figure 38**.

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

AMPS-1 sends the respiration signal to either the Left Arm (LA) or Left Leg (LL) ECG lead as selected by the RESP button located on the right of AMPS-1.

### 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, 0.05, 0.1, 0.2, 0.5, 1, 2, 3, 4 and 5 $\Omega$

#### 7.2.3 Rates

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

#### 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

#### 7.2.6 Ventilator wave simulation

## 7.3 Respiration Function

Parameters provided for the respiration function are: Rate, Apnea, Impedance, Delta and I/E Ratio. A ventilator simulation can also be selected.

Pressing the RESP button will enter the respiration main menu (**Figure 42**).

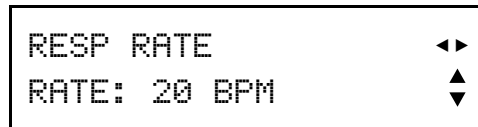


Figure 43- RESPIRATORY RATE

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 43**.

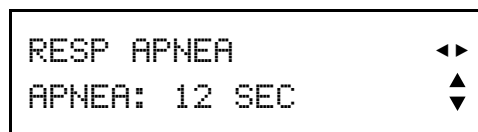


Figure 44- RESPIRATORY APNEA

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 44**.

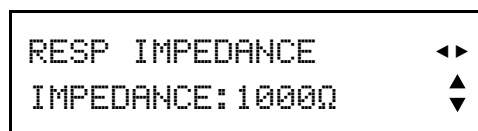


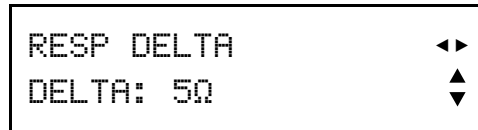
Figure 45- RESPIRATORY IMPEDANCE

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



## AMPS-1 OPERATING MANUAL

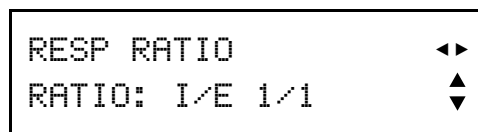
Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 45**.



**Figure 46 - RESPIRATORY DELTA**

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the impedance deviation: 0, 0.05, 0.1, 0.2, 0.5, 1, 2, 3, 4 and 5Ω.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 46**.



**Figure 47- RESPIRATORY RATIO**

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the respiratory ratio: Inhale/Exhale 1/1, 2/1, 3/1, 4/1, and 5/1. A ventilator simulation is also provided under this parameter.

Pressing the RIGHT (▶) arrow button will restore the LCD display to the initial menu screen of **Figure 42**.

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.

## **AMPS-1 OPERATING MANUAL**

**Chapter**

**8**

## **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.

AMPS-1 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, 100, 200, 500 and 700 mV

#### **8.2.3 Pacer Pulse Widths**

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

## AMPS-1 OPERATING MANUAL

### 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.

Pressing the PACER button will change the menu screen to that of **Figure 47**.

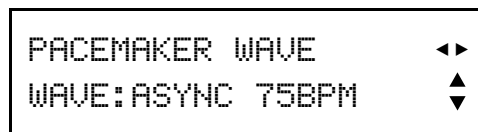


Figure 48- PACER WAVEFORM

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 48**.

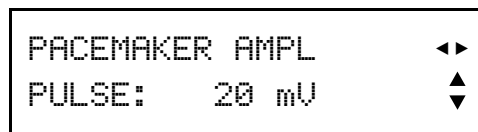


Figure 49- PACER AMPLITUDE

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, 100, 200, 500 and 700 mV.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 49**.

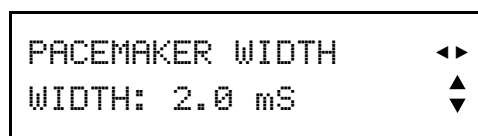
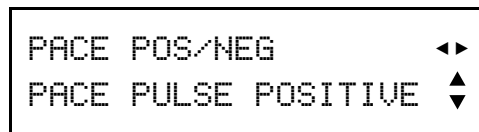


Figure 50- PACER PULSE WIDTH

## AMPS-1 OPERATING MANUAL

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 50**.



**Figure 51-** PACER POLARITY

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 **Figure 47**.

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.

## **AMPS-1 OPERATING MANUAL**

**Chapter**

**9**

## 9 Temperature

### 9.1 Overview

AMPS-1 temperature simulations are compatible with Yellow Springs Inc. (YSI) Series 400 and 700 probes. AMPS-1 automatically recognizes and selects the appropriate simulation based on the adaptor cable connected to the TEMPERATURE jack.

AMPS-1 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, AMPS-1 automatically senses the adapter connected at the TEMPERATURE jack (YSI 400 or 700).

Pressing the TEMP/CO(8) button will change the menu screen to that of **Figure 51**.

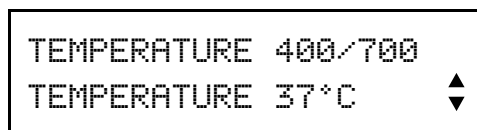


Figure 52- TEMPERATURE

## **AMPS-1 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 AMPS-1.

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 Cardiac Output (optional)**

### **10.1 Overview**

Cardiac Output (CO) is the measurement of the volume of blood expelled by either ventricle of the heart. It is customarily expressed as minute volume, or liters of blood per minute, calculated as the product of stroke volume (ventricle output per heartbeat) and the number of beats per minute.

A common method of measuring cardiac output is thermodilution; measurement of the change in temperature in the bloodstream after injecting a measured amount of cool fluid (such as saline).

The Cardiac Output Option and Cardiac Output Adapter Box are required to perform this simulation. See Appendix B - ACCESSORIES for part numbers.

### **10.2 Available Settings**

Press ENTER after selecting a parameter to activate that setting.

#### **10.2.1 Injectate Thermistor Type**

- H-P/Philips compatible, at 2 °C
- H-P/Philips compatible, at 20 °C
- American Edwards/Spacelabs compatible, at 2 °C
- Adjustable (default Edwards/Spacelabs compatible, at 20 °C)

#### **10.2.2 Baseline Temperature**

- 36, 37, and 38 °C

#### **10.2.3 Injectate Temperature**

- 2 °C or 20 °C

## AMPS-1 OPERATING MANUAL

### 10.2.4 Cardiac Outputs

- 3, 4, 4.5, 5, 5.5, 6, 6.5 and 7 liters per minute

### 10.2.5 Simulation Types

- Trend On/Off
- Slow injection
- Faulty injection
- Left-to-right shunt
- Calibration pulse (1 °C for 1 or 4 seconds)

## 10.3 Setup

Configure the cardiac output monitor to the following settings:

CATHETER TYPE / SIZE:                      Baxter Edwards, 93a 131 7f

CALIBRATION COEFFICIENT:                0.542 for 2 °C Injectate  
0.595 for 20 °C Injectate

INJECTATE VOLUME:                          10 cc

INJECTATE TEMPERATURE:                2 °C or 20 °C

Connect the Cardiac Output Adapter box (P/N 8000-454) to the AUX input on AMPS-1, using the 8-pin mini-DIN cable supplied with the adaptor.

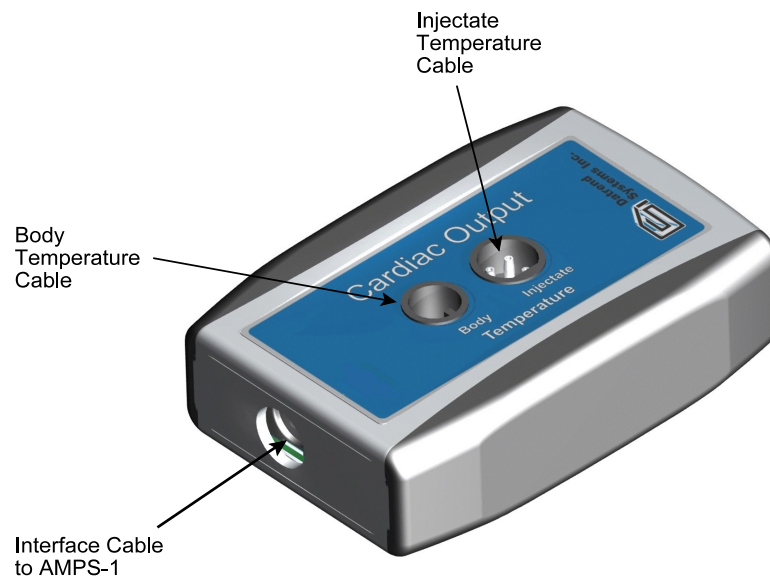


Figure 53 - Cardiac Output Adapter

## AMPS-1 OPERATING MANUAL

Connect the body temperature cable from the cardiac output monitor to the BODY connector on the AMPS-1 Cardiac Output adapter.

Connect the injectate temperature cable from the cardiac output monitor to the INJECTATE connector on the AMPS-1 Cardiac Output adapter.

### 10.4 Cardiac Output Function (optional)

Note: Cardiac Output Function is an optional feature and must be activated before it can be used.

Pressing the TEMP/CO button from the Temperature Function (or twice from any other menu) will change the menu screen to that of **Figure 53**.

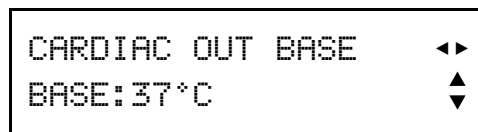


Figure 54- CARDIAC OUTPUT

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the baseline body temperature: 36, 37 and 38 °C.

Pressing the RIGHT (▶) button will change the menu screen to that of **Figure 54**.

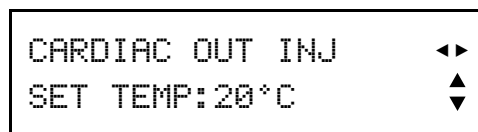


Figure 55- CO INJECTATE

Press the UP (▲) or DOWN (▼) arrow button to toggle between an injectate temperature of 2 °C and 20 °C.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 55**.

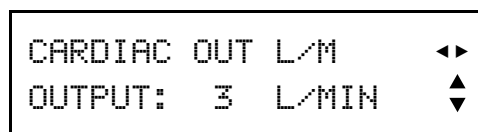
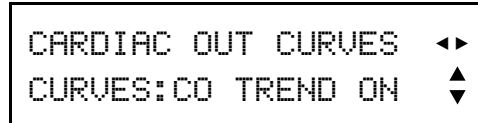


Figure 56- CO L/M

## AMPS-1 OPERATING MANUAL

Press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided for the cardiac output rate: 3, 4, 4.5, 5, 5.5, 6, 6.5 and 7 L/MIN.

Pressing the RIGHT (►) arrow button will change the menu screen to that of **Figure 56**.

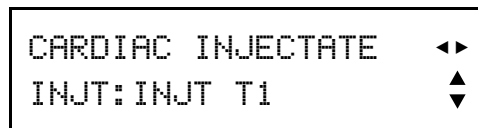


A rectangular menu screen with a black border. The text is in a monospaced font. The first line reads "CARDIAC OUT CURVES" followed by a right-pointing arrow icon (►). The second line reads "CURVES:CO TREND ON" followed by a down-pointing arrow icon (▼).

**Figure 57- CO CURVE**

Press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided: CO TREND ON, CO TREND OFF, SLOW, FAULTY INJ, L/R SHUNT, CAL 1D/1SEC, 1D/4SEC. These settings correspond to various types of cardiac output simulation, including abnormal injections and calibration pulses.

Pressing the RIGHT (►) arrow button will change the menu screen to that of **Figure 57**.



A rectangular menu screen with a black border. The text is in a monospaced font. The first line reads "CARDIAC INJECTATE" followed by a right-pointing arrow icon (►). The second line reads "INJT:INJT T1" followed by a down-pointing arrow icon (▼).

**Figure 58- CO INJECTATE**

Press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided: INJT T1, INJT T2, INJT T3 and INJT T4. These settings correspond to the type of injectate thermistor that would normally be connected to the monitor, and also the injectate temperature being measured by the thermistor. The thermistor settings are interpreted as follows:

INJT T1: Compatible with H-P and Philips monitors; injectate solution at 2 °C

INJT T2: Compatible with H-P and Philips monitors; injectate solution at 20 °C

INJT T3: Compatible with Edwards and Spacelabs monitors; injectate at 2 °C

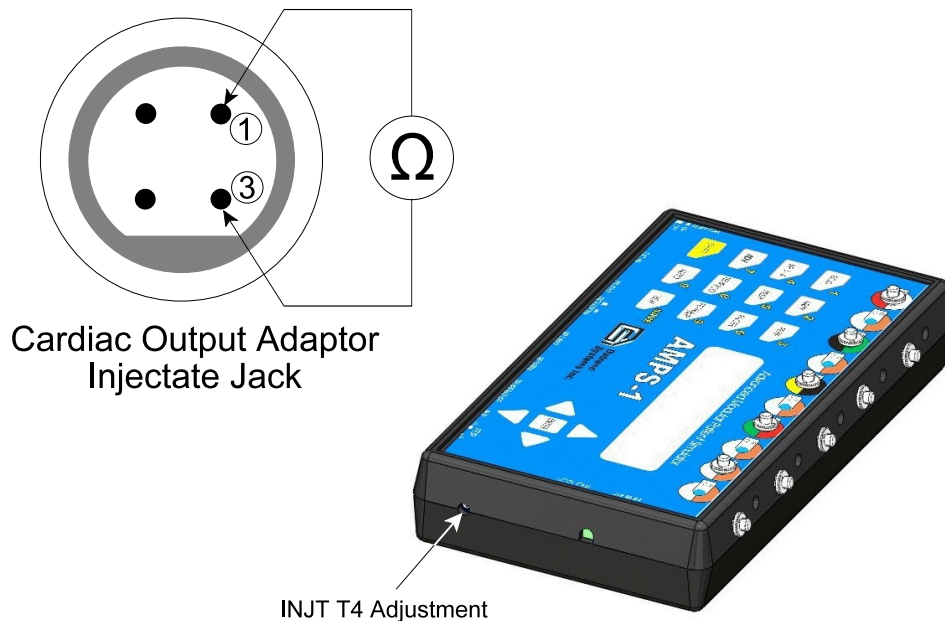
INJT T4: Adjustable via a variable resistor ("trimpot"), accessible through a hole on the right side of AMPS-1 (see **Figure 58**)

## AMPS-1 OPERATING MANUAL

The factory default setting for the INJT T4 trimpot corresponds to an injectate thermistor which is compatible with Edwards/Spacelabs monitors, with the injectate solution at 20 °C. If necessary, this trimpot can be adjusted to accommodate other cardiac output monitors or alternative injectate temperatures as required.

To re-calibrate the INJT T4 trimpot to suit an alternate CO monitor, consult the operator or service manual of the monitor to determine the resistance specification for the injectate thermistor at the required injectate temperature. For example, for an American Edwards or Spacelabs system and 20 °C injectate solution, the nominal thermistor resistance would be 67.7 kilo-ohms (k $\Omega$ ). This is the factory default setting of the INJT T4 trimpot.

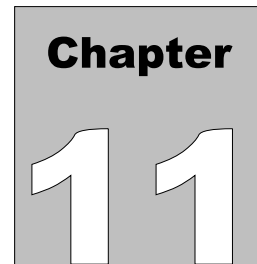
Enter the CO menu of AMPS-1 and select INJT T4 under CARDIAC INJECTATE. Disconnect the CO monitor from the Cardiac Output Adaptor 8000-454, and use an ohmmeter to probe pins 1 and 3 of the "Injectate" jack on the adaptor (see **Figure 58**). Adjust the INJT T4 trimpot of AMPS-1 until the required resistance is indicated on the ohmmeter. The trimpot may be tuned over a range of approximately 0.1 to 100 k $\Omega$ .



INJT T4 Adjustment  
**Figure 59- Calibration of INJT T4 trimpot**

Once the INJT T4 trimpot has been calibrated, the Cardiac Output Adaptor can then be connected to the CO monitor via the associated body and injectate temperature cables.

## **AMPS-1 OPERATING MANUAL**



# 11 Fetal ECG and Intrauterine Pressure (optional)

## 11.1 Overview

AMPS-1 simulates fetal ECG and intrauterine pressures as observed during labour.

The simulated fetal signal represents a measurement from a fetal scalp electrode on the normal ECG leads.

The intrauterine pressure (IUP) waveform simulates the measurements of a pressure transducer during contractions. Transducer sensitivity can be set to either 5 or 40  $\mu\text{V}/\text{V}/\text{mmHg}$  for this simulation.

## 11.2 Available Settings

Press ENTER after selecting a parameter to activate that setting.

### 11.2.1 Fetal Heart Rates

- 60, 90, 120, 150, 180, 210, and 240 BPM

### 11.2.2 Fetal Heart Rate Variation

- Uniform, early and late deceleration

### 11.2.3 Dynamic Intrauterine Pressure (IUP) waveform

- Positive bell-shaped pressure curve

### 11.2.4 Peak Intrauterine Pressure

- 25, 50 and 100 mmHg

### 11.2.5 Contraction Duration

- 90 seconds

## AMPS-1 OPERATING MANUAL

### 11.2.6 Transducer Sensitivity

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

### 11.2.7 Optional Mechanical Fetal Heart

- Mechanical pulse (40 msec) at the selected fetal heart rate

## 11.3 Optional Mechanical Fetal Heart

The Mechanical Fetal Heart (P/N: 8000-455), an optional accessory for AMPS-1, provides a mechanical impulse to test the crystal function of an ultrasound transducer.

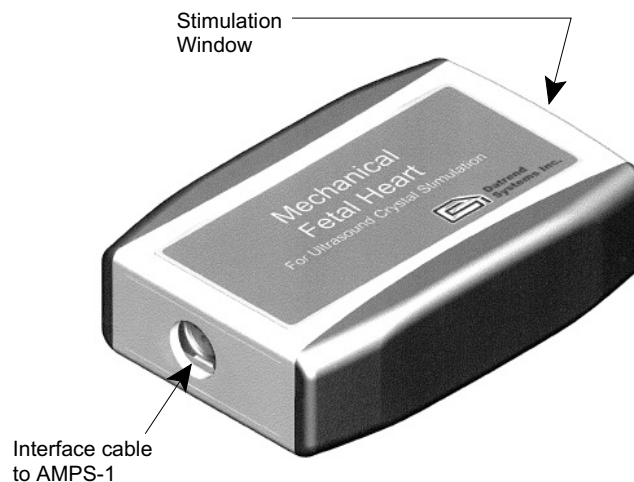


Figure 60- Mechanical Fetal Heart

Connect the Mechanical Fetal Heart accessory to the AUX output of AMPS-1 using the 8-pin mini-DIN cable supplied with the accessory.



As the mechanism draws significant electrical power in operation, the Mechanical Fetal Heart requires AMPS-1 to be powered by the optional AC adaptor (P/N 3000-445 for USA/Japan; P/N 3000-446 for continental Europe; or P/N 3000-447 for UK). Connect the AC adaptor which is appropriate for your region to the DC IN jack of AMPS-1.

The ultrasound transducer should be placed face up on a stable work surface and coated with ultrasound conductive gel.

The Mechanical Fetal Heart outputs a periodic impulse via the stimulation window. This window must be placed over each crystal of the transducer in turn to verify each crystal's function.



## AMPS-1 OPERATING MANUAL

After use, the unit must be cleaned with a mild soap solution and warm water, then dried with a soft, absorbent cloth.



The Mechanical Fetal Heart contains liquid. It should be stored in an upright position with the stimulation window face down. The Mechanical Fetal Heart *must not* be subjected to freezing temperatures.

### 11.4 Fetal ECG Simulations

Note: Fetal Simulations are an optional feature and must be activated before they can be used.

Pressing the FETAL/IUP button once will change the menu screen to that of **Figure 60**.

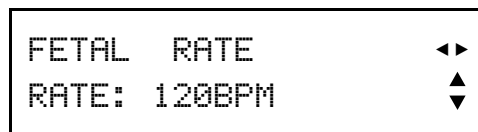


Figure 61- FETAL HEART RATE

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the fetal heart rate: 60, 90, 120, 150, 180, 210 and 240 BPM.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 61**.

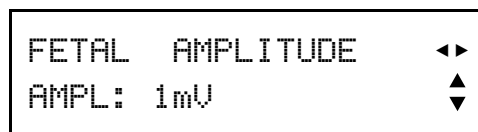


Figure 62- FETAL HEART AMPLITUDE

Press the UP (▲) or DOWN (▼) arrow button to scroll through the settings provided for the fetal ECG amplitude: 0.1, 0.25, 0.5, 1, 2, 3, 4 and 5 mV.

Pressing the RIGHT (▶) arrow button will change the menu screen to that of **Figure 62**.

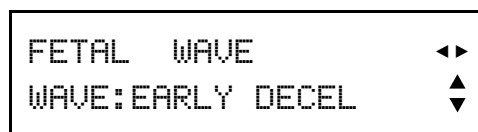


Figure 63- FETAL HEART WAVEFORM

## AMPS-1 OPERATING MANUAL

Press the UP (▲) or DOWN(▼) arrow button to scroll through the fetal ECG simulations provided: EARLY DECEL, LATE DECEL, UNIFORM DECEL.

Pressing the RIGHT (►) arrow button will restore the LCD display to the initial menu screen of **Figure 60**.

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.

### 11.5 Intrauterine Simulations

Using the appropriate IUP cable as listed in Appendix B, connect the patient monitor to the **BP-1** channel of AMPS-1.

Pressing the FETAL/IUP button while in any of the FETAL menu screens will change the menu screen to that of **Figure 63**.

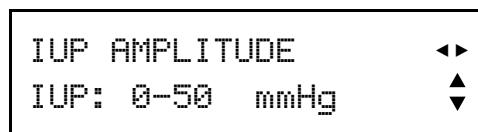


Figure 64- IUP AMPLITUDE

Press the UP (▲) or DOWN(▼) arrow button to scroll through the settings provided for IUP amplitude: 0 to 25 mmHg; 0 to 50 mmHg; and 0 to 100 mmHg.

Pressing the RIGHT (►) arrow button will change the menu screen to that of **Figure 64**.

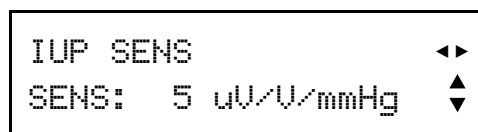


Figure 65- IUP PRESSURE

## **AMPS-1 OPERATING MANUAL**

Press the UP (▲) or DOWN (▼) arrow button to toggle the transducer sensitivity between 5 and 40  $\mu\text{V}/\text{V}/\text{mmHg}$ .

Pressing the RIGHT (▶) or LEFT (◀) arrow buttons will toggle the LCD display between amplitude and sensitivity parameters.

Press ENTER after selecting a parameter to activate your selection.

## **AMPS-1 OPERATING MANUAL**

## 12 Automated Settings

### 12.1 Overview

The Automated Settings of AMPS-1 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 the *AMPSpc* software, as described in Section 13.4 of this manual.

### 12.2 Choosing an Auto Setting

With AMPS-1 in the ALPHA operating mode (the default mode after powering up), press the AUTO (0) button.

Pressing the LEFT (◀) or RIGHT (▶) arrow buttons will scroll the display through the Auto setups AUTO1 to AUTO10, as indicated in **Figure 65**.

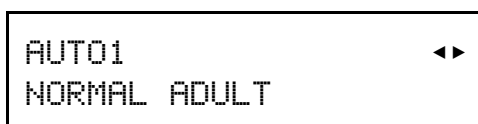


Figure 66 - Auto selection, ALPHA mode

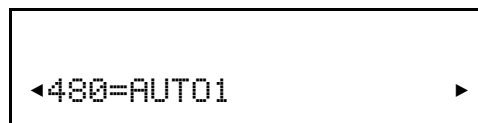
When the desired Auto setup is displayed, press ENTER to activate the parameters of that Auto.

Auto setups can also be selected when operating AMPS-1 in NUMERIC mode. Press SHIFT to toggle AMPS-1 from ALPHA to NUMERIC mode, then enter the three digits corresponding to the desired Auto setting as listed below, then press ENTER to activate the indicated Auto setup.

## AMPS-1 OPERATING MANUAL

480 - AUTO1	485 - AUTO6
481 - AUTO2	486 - AUTO7
482 - AUTO3	487 - AUTO8
483 - AUTO4	488 - AUTO9
484 - AUTO5	489 - AUTO10

As an alternative to entering the numeric code directly, pressing the LEFT (◀) or RIGHT (▶) arrow buttons in NUMERIC mode will scroll the LCD display through all simulator settings provided by AMPS-1, including the Auto setups.



**Figure 67-** Auto selection, NUMERIC mode

When the desired Auto is displayed on the LCD, press ENTER to activate the parameters of that Auto setup.

Once an Auto setup has been selected, the simulator parameters configured by that Auto will remain in effect until one or more of the parameters are modified via the various menus provided by AMPS-1, or until AMPS-1 is powered down.

Chapter  
13

## 13 AMPSpC Companion Software

### 13.1 Overview

*AMPSpC*, companion software to AMPS-1, allows you to program power-on default settings for 20 simulation parameters of AMPS-1. *AMPSpC* also allows you to create or modify up to 10 Auto setups for rapid selection of multi-parameter patient simulations. Once created or updated in *AMPSpC*, power-on and Auto settings may then be transferred to AMPS-1 via RS-232.

### 13.2 Connecting AMPS-1 to a PC

Connect the serial communications cable (P/N 3140-429) provided with AMPS-1 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 AMPS-1.

Power up AMPS-1 by pressing the POWER pushbutton. AMPS-1 will power up in ALPHA mode by default, but AMPS-1 will communicate with your PC from either ALPHA or NUMERIC mode. There is no need to set AMPS-1 to a particular mode for computer communications.

After installing AMPSpC from the CD (supplied), run the program by double-clicking on the "AMPSpC" icon on your desktop. Click the SETTINGS tab of *AMPSpC*, then select the appropriate communications port (COM Port) from the drop-down menu (Figure 67).

## AMPS-1 OPERATING MANUAL

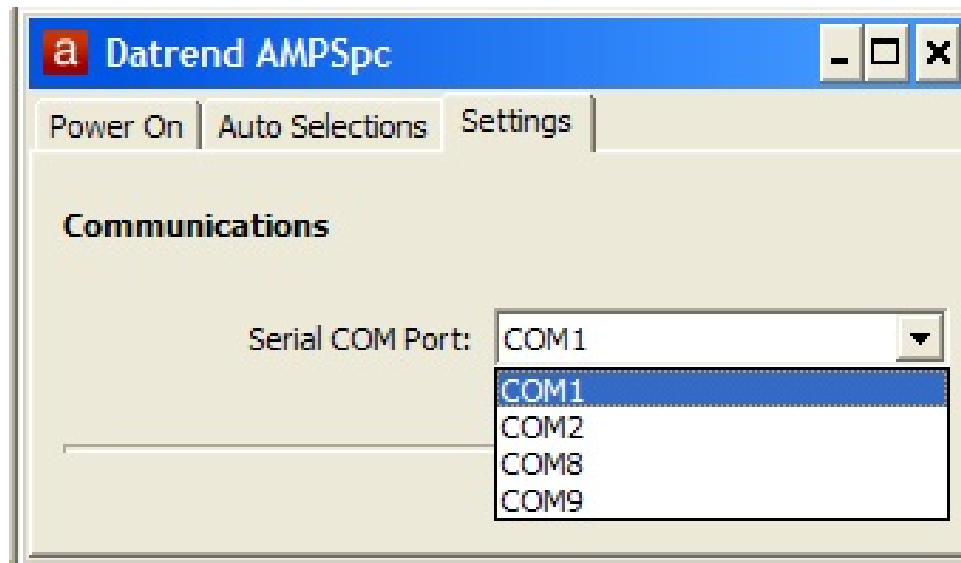


Figure 68- COM Port settings



### 13.3 Programming Power-On Defaults

The factory default settings for AMPS-1 may be changed on the AMPS-1 itself, as described in Chapter 2 of this manual, or may be changed using *AMPSpc* and then uploaded to AMPS-1.

Power-on parameters of AMPS-1 and the corresponding settings for those parameters are as follows:

ECG Rate:	30, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280 or 300 BPM
ECG Amplitude:	0.1, 0.25, 0.5, 1, 2, 3, 4 or 5mV
ECG Axis:	Normal (INT), Horizontal or Vertical
ECG Baseline Impedance:	500, 1000, 1500 or 2000Ω
ECG R-Wave:	Adult R-Wave or Neonatal R-Wave
Respiration Rate:	0, 15, 20 30, 40, 60, 80, 100 or 120 BPM
Respiration Waveform:	I/E 1/1, I/E 2/1, I/E 3/1, I/E 4/1, I/E 5/1, or Ventilator
Respiration Delta:	0, 0.05, 0.1, 0.2, 0.5, 1, 2, 3, 4 or 5Ω
Pacer Pulse Amplitude:	2, 4, 8, 10, 12, 14, 16, 18, 20, 50, 100, 200, 500 or 700 mV
Pacer Pulse Width:	0.1, 0.2, 0.5, 1.0 or 2.0 msec
Pacer Pulse Polarity:	Negative or Positive Pulse
Temperature YSI 400/700:	30, 35, 37, 38 or 40 °C
CO Injectate Temperature:	2 or 20 °C
CO Baseline Temperature:	36, 37 or 38 °C
CO Injectate Thermistor:	H-P/Philips compatible, 2 or 20°C; American Edwards/Spacelabs compatible, at 2°C; or Adjustable (default Edwards/Spacelabs at 20°C)
BP Sensitivity:	5 or 40 μV/V/mmHg
BP1 to BP4 Dynamic: (settings are independent for each channel)	Arterial - 120/80, 90/40, or 160/110 Ventricular - Left 120/0, or Right 25/0 Pulmonary - Artery 25/10, or Wedge 10/2

## AMPS-1 OPERATING MANUAL

Note that BP Dynamic settings as listed above do not apply immediately after switching on the power to AMPS-1. Instead, at power-up AMPS-1 initially sets all BP channels to zero pressure so that the monitor under test can be zeroed. After zeroing the pressure channels of the patient monitor, BP Dynamic waveforms as programmed by *AMPSPc* are then activated by pressing **SHIFT-3-ENTER** on the AMPS-1 keypad.

To set or change a power-on default of AMPS-1, click on the "Power On" tab of *AMPSPc* (Figure 68).

No.	Power On Option	Power On Value
1	ECG Rate	80 BPM
2	ECG Amplitude	1 mV
3	ECG Axis	Normal (INT)
4	ECG Baseline Impedance	1000 Ohms
5	ECG R-Wave	Adult R-Wave
6	Respiration Rate	20 BPM
7	Respiration Waveform	I/E 2/1
8	Respiration Delta	5 Ohms
9	Pacer Pulse Amplitude	20 mV
10	Pacer Pulse Width	1 msec
11	Pacer Pulse Polarity	Negative Pulse
12	Temperature YSI 400/700	37° C
13	CO Injectate Temperature	2° C
14	CO Baseline Temperature	37° C
15	CO Injectate Thermistor	Edwards/SpaceLabs at 2°C
16	BP Sensitivity	5µV/V per mmHg
17	BP1 Dynamic	Arterial 120/80
18	BP2 Dynamic	Left Ventricular 120/0
19	BP3 Dynamic	Pulmonary Artery 25/10
20	BP4 Dynamic	Right Ventricular 25/0

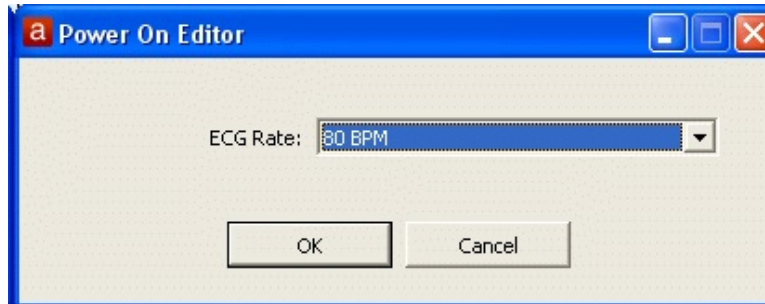
Set Power On Values

Figure 69- AMPSPc Power-On Editor

Double-click on a desired setting in the table (1 - 20), or highlight the setting and press the "Edit Power On Value" button (pencil icon).

## AMPS-1 OPERATING MANUAL

The Power On Editor window (**Figure 69**) will open, containing a drop-down box which lists all possible settings for the parameter being edited.

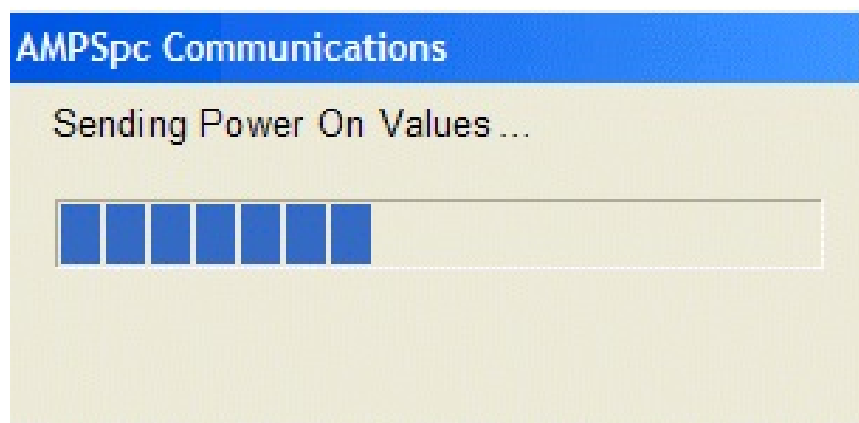


**Figure 70-** Editing a Power-On value.

Choose the desired setting and press OK to accept, or press Cancel to leave the setting as it was.

When all desired power-on defaults have been set, press "Set Power On Values". This will upload the power-on settings to AMPS-1 via the RS-232 serial connection. The settings will then be stored in the non-volatile memory of AMPS-1.

During the upload, *AMPSpc* will give an indication of progress (**Figure 70**), although the AMPS-1 display will remain unchanged.



**Figure 71 -** AMPSpc Progress Indicator

For the settings to take effect, it is necessary to restart AMPS-1. After uploading, reset AMPS-1 by switching the power off, waiting one second, then switching the power back on.

### 13.4 Auto Selections

The Auto Selections feature of *AMPSPc* allows you to create or modify up to 10 custom simulation setups for AMPS-1. After uploading the Auto setups to AMPS-1, multiple simulation parameters can then be quickly changed at once, via the AUTO key on the AMPS-1 keypad.

Any Auto setup may include up to 10 parameter settings.

*AMPSPc* organizes Auto setups into five Categories. Parameters and settings vary by Category, but all Categories include settings for Body Temperature and Cardiac Output.

Type of Auto: Multi-parameter Simulation

ECG Tab:

Rate  
Amplitude  
Impedance  
ST Depression  
Axis  
Neonatal  
Artifact

Blood Pressure Tab:

Sensitivity  
Static Level  
BP1 Dynamic  
BP2 Dynamic  
BP3 Dynamic  
BP4 Dynamic  
Artifact

Respiration Tab:

Rate  
Apnea  
Delta  
Waveform

Temperature and CO Tab (available in all Types):

Temperature YSI 400/700  
Baseline Temperature  
Injectate Thermistor Type  
Injectate Temperature  
Cardiac Output  
Simulation Type

Type of Auto: Arrhythmia Simulation

Arrhythmia Tab:

Arrhythmia Waveform

Temperature and CO Tab:

(See above)

Type of Auto: Fetal Simulation

Fetal/IUP Tab:

Fetal ECG Base Rate  
Fetal ECG Amplitude  
ECG Rate Variation  
Intrauterine Pressure

Temperature and CO Tab:

(See above)

## AMPS-1 OPERATING MANUAL

Type of Auto: Paced ECG Simulation

Pacer Tab:

Waveform  
Pulse Polarity  
Pulse Amplitude  
Pulse Width

Temperature and CO Tab:

(See above)

Type of Auto: ECG Performance Test

Performance Tab:

Square/triangle  
Sine Wave  
Haver-triangle  
Signal Amplitude

Temperature and CO Tab:

(See above)

To set or change an Auto setup, select the "Auto Selections" tab in *AMPSPc* (**Figure 71**).

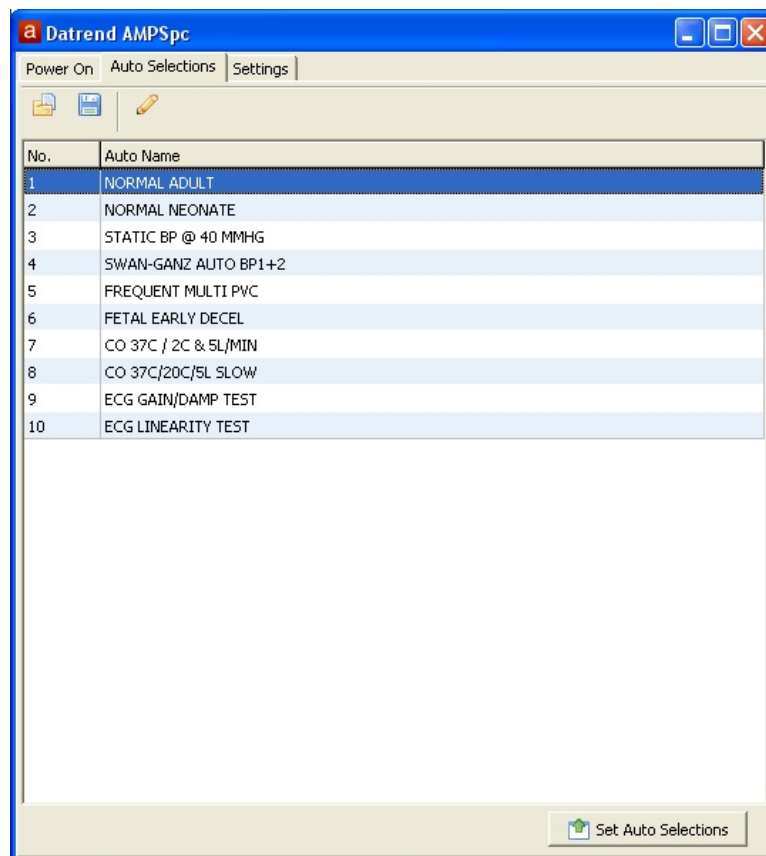


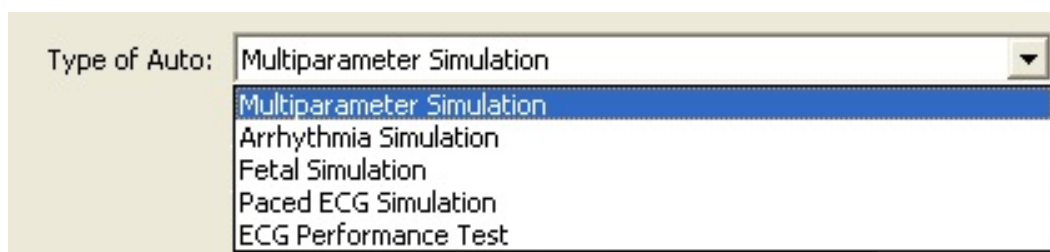
Figure 72 - Auto Selections

## AMPS-1 OPERATING MANUAL

To edit an Auto setup, double-click on a row in the table, or highlight the row and then press the "Edit Auto Selection" button (pencil icon).

You can name or rename any of the Auto setups using up to 20 characters.

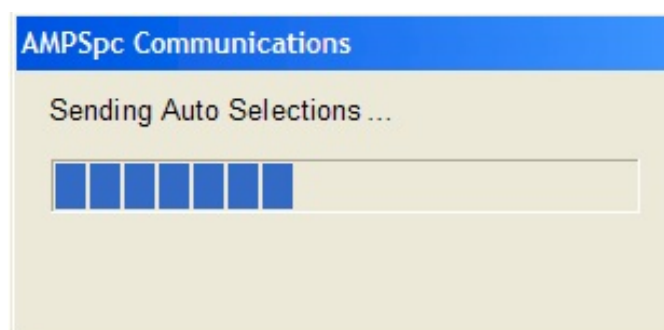
Using the "Type of Auto" drop-down, choose the desired type of Auto setup (**Figure 72**).



**Figure 73** - Select type of Auto

As shown in **Figure 72**, each type of Auto will provide specific simulator parameters and a range of settings for each parameter. Each Auto may include up to 10 such settings.

When you are finished editing the Auto setups, click OK to exit the editor. Press "Set Auto Selections" to upload the Auto setups to AMPS-1 via the RS-232 connection. *AMPSpc* will give an indication of progress (**Figure 73**), although the AMPS-1 display will remain unchanged during the upload.



**Figure 74** - AMPSpc Progress Indicator

For the settings to take effect, it is necessary to restart AMPS-1. After uploading, reset AMPS-1 by switching the power off, waiting one second, then switching the power back on.

**Chapter**  
**14**

## **14 Controlling AMPS-1 with a PC**

### **14.1 Overview**

AMPS-1 may be controlled directly from a personal computer via RS-232. Control is effected by sending 3 digit numeric codes to AMPS-1. The numeric codes can be found in Appendix A.

### **14.2 Connecting AMPS-1 to a PC**

Connect the serial communications cable (P/N 3140-429) provided with AMPS-1 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 AMPS-1.

Power up AMPS-1 by pressing the POWER pushbutton. AMPS-1 will power up in ALPHA mode by default, but AMPS-1 will communicate with your PC from either ALPHA or NUMERIC mode. There is no need to set AMPS-1 to a particular mode for computer communications.

The serial protocol used by AMPS-1 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.

### 14.3 AMPS-1 Command Interface Specifications

The remote commands which control AMPS-1 are listed in Appendix A 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 AMPS-1.

For remote control, the AMPS-1 must first be placed in "NUMERIC mode". This can be done manually by the user, by pressing the SHIFT button on the front panel of AMPS-1 prior to commencement of remote control operation. Alternatively, AMPS-1 can be switched from power-on default "ALPHA" mode to the "NUMERIC" mode by sending an ASCII 'M' character to AMPS-1, prior to transmission of subsequent remote control commands.

Command examples:

<u>Description</u>	<u>Command</u>
Switch from ALPHA to NUMERIC mode	M
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

AMPS-1 has special requirements for remote control via RS-232. Characters sent to AMPS-1 by a controlling device must be separated by a delay of at least two-tenths of a second. In response to each character received by AMPS-1 via the RS-232 Port, AMPS-1 will return a string of 22 characters to the sending device, which can be either accepted or discarded depending on the desired application.

For example, considering the Coarse AFIB command listed above, the sending device will require at least 0.8 seconds to send this message to AMPS-1, and AMPS-1 will return four messages of 22 characters each to the sending device over the course of the command transmission. After the first ASCII character '1' is sent, there needs to be a 0.2 second pause to allow the AMPS-1 to respond with a 22 character message. 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.



Chapter  
**15**

# 15 Enabling Optional Features

## 15.1 Overview

In addition to the standard simulations provided by AMPS-1 (ECG, arrhythmia, defibrillator training, performance waves, respiration, pacer and body temperature), optional simulations may be purchased and added at any time: 2 or 4 Electrically Isolated BP Channels, Cardiac Output, and Fetal ECG/IUP simulations.

## 15.2 Adding Optional Features

Contact your local Distributor or Datrend Systems Customer Service at (604) 291-7747 or (800) 667-6557 (North America only). Be prepared to provide your AMPS-1 serial number.

Upon purchasing the optional feature, you will receive a 10-digit code to enable the option. This code is serial number specific and will be valid only for the serial number you provide.

Power up AMPS-1 and select NUMERIC mode by pressing the SHIFT key. Input three digits corresponding to the option you wish to enable, then press the ENTER key. The numeric codes for the optional simulations are:

- 505 BP Channel 1 and Channel 2
- 506 BP Channel 3 and Channel 4
- 508 Cardiac Output
- 509 Fetal ECG/IUP

After inputting the desired numeric code (505; 506; 508; or 509) and pressing ENTER, the screen of **Figure 74** will be displayed.

## AMPS-1 OPERATING MANUAL



Figure 75- OPTION ENABLE

Enter the 10-digit code provided by your Distributor or Datrend Systems. As you type, “#####” will appear on the screen. Once you enter the correct 10-digit code, you will receive a message on the screen advising you that the option has been successfully enabled. In this case, press SHIFT to return to ALPHA mode. Power-down AMPS-1, wait one second, then power up AMPS-1. Verify the option has been enabled by pressing the corresponding key on the keypad.

If you mis-type or enter an incorrect code, "ENABLE MODE OFF" will appear on the screen. In this case, press SHIFT twice to exit and return to NUMERIC mode, then try again.

**Chapter**  
**16**

## 16 Calibration and Maintenance

Calibration of AMPS-1 by a Datrend Authorized Service facility is recommended on an *annual* basis, and is *required* to extend the product warranty. The basic one (1) year warranty can be extended to a maximum of five (5) years provided that calibration is performed by a Datrend Authorized Service Center on an *annual* basis.

Refer to the Calibration Decal applied on the back of the unit to determine calibration status of your AMPS-1.

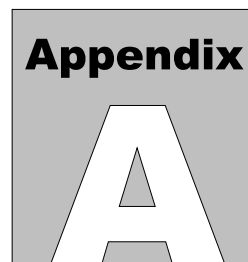
AMPS-1 contains no user serviceable parts. *Opening the case of AMPS-1 for any reason will void the warranty.*

For calibration or service assistance, contact Datrend for a Return Materials Authorization (RMA) number and 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)

AMPS-1 should be cleaned with a soft, lint free, damp cloth. Use of cleaning agents may result in scratching, discoloration, or streaking.

## **AMPS-1 OPERATING MANUAL**



## Appendix A - Numeric Mode

Every function or setting provided by AMPS-1 corresponds to a preset 1, 2 or 3 digit number. When AMPS-1 is in NUMERIC mode, entering numbers on the keypad and pressing ENTER will activate the desired function or setting. An alternative way of selecting an option in NUMERIC mode is to use the LEFT (◀) or RIGHT (▶) arrow buttons to scroll through the available options. Once found, press ENTER to activate that particular function or setting. There are 512 selections available, numbered from zero to 511, as listed in the table in this Appendix.

By default, AMPS-1 powers up in ALPHA mode. To change to NUMERIC mode, press the SHIFT button. The NUMERIC mode display will then appear, as illustrated in **Figure 75**.

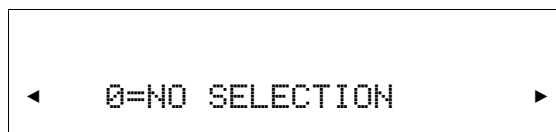


Figure 76 - Numeric Mode

The table on the following page lists the numeric codes for all AMPS-1 settings, organized by GROUP. Find the desired setting in the table, type the corresponding 1, 2 or 3 digit code on the keypad and press ENTER to activate that setting.

If you enter the wrong code, press the UP (▲) or DOWN (▼) arrow button, and you will be taken back to the display of **Figure 75**. Input a revised 1 to 3 digit number, then press ENTER.

## AMPS-1 OPERATING MANUAL

### UTILITY

1 - TEST BATTERY  
497 - BEEP TEST  
498 - DISPLAY SER #  
510 - KEY BEEP ON  
511 - KEY BEEP OFF

### POWER-ON

154 - PON SENS 5 $\mu$ V  
155 - PON SENS 40 $\mu$ V  
261 - C.O. PON 2°  
262 - C.O. PON 20°  
263 - C.O. PON T1  
264 - C.O. PON T2  
265 - C.O. PON T3  
266 - C.O. PON T4

### ECG

4 - NSR @80BPM  
8 - AXIS NORMAL  
9 - ALL ARTIF OFF  
10 - ECG 30 BPM  
11 - ECG 40 BPM  
12 - ECG 60 BPM  
13 - ECG 80 BPM  
14 - ECG 100 BPM  
15 - ECG 120 BPM  
16 - ECG 140 BPM  
17 - ECG 160 BPM  
18 - ECG 180 BPM  
19 - ECG 200 BPM  
20 - ECG 220 BPM  
21 - ECG 240 BPM  
22 - ECG 260 BPM  
23 - ECG 280 BPM  
24 - ECG 300 BPM  
26 - ECG AMP 0.1mV  
27 - ECG AMP 0.25mV  
28 - ECG AMP 0.5mV  
29 - ECG AMP 1mV  
30 - ECG AMP 2mV  
31 - ECG AMP 3mV  
32 - ECG AMP 4mV  
33 - ECG AMP 5mV  
40 - BL IMP 500OHM

41 - BL IMP 1000OHM  
42 - BL IMP 1500OHM  
43 - BL IMP 2000OHM  
64 - NSR @80BPM  
119 - NSR @80BPM  
129 - NSR @80BPM  
143 - ARTIFACT OFF  
144 - ECG MUSCLE ART  
145 - ECG WANDERING  
146 - ECG 50Hz ART  
147 - ECG 60HZ ART

### ADVANCED ECG

44 - ST DEPR 0mV  
45 - ST DEPR -0.8mV  
46 - ST DEPR -0.7mV  
47 - ST DEPR -0.6mV  
48 - ST DEPR -0.5mV  
49 - ST DEPR -0.4mV  
50 - ST DEPR -0.3mV  
51 - ST DEPR -0.2mV  
52 - ST DEPR -0.1mV  
53 - ST DEPR +0.1mV  
54 - ST DEPR +0.2mV  
55 - ST DEPR +0.3mV  
56 - ST DEPR +0.4mV  
57 - ST DEPR +0.5mV  
58 - ST DEPR +0.6mV  
59 - ST DEPR +0.7mV  
60 - ST DEPR +0.8mV  
61 - AXIS NORMAL  
62 - AXIS HORIZONTAL  
63 - AXIS VERTICAL  
65 - NEONATAL ON  
66 - NEONATAL OFF

### ARRHYTHMIA

67 - ASYSTOLE 1  
68 - ASYSTOLE 2  
69 - ASYSTOLE 3  
70 - BIGEMINY1 LVF  
71 - BIGEMINY2 RVF  
72 - TRIGEMINY1 LVF  
73 - TRIGEMINY2 RVF  
74 - PAC

75 - PNC  
76 - MULTIFOCAL PVC  
77 - FREQ MULTI PVC  
78 - PVC1 LVF\*  
79 - PVC1 EARLY LV\*  
80 - PVC1 RonT LVF\*  
81 - PVC1 6/MIN  
82 - PVC1 12/MIN  
83 - PVC1 24/MIN  
84 - PVC1 PAIR\*  
85 - PVC1 RUN 5\*  
86 - PVC1 RUN 11\*  
88 - PVC2 RVF\*  
89 - PVC2 EARLY RV\*  
90 - PVC2 RonT RVF\*  
91 - PVC2 6/MIN  
92 - PVC2 12/MIN  
93 - PVC2 24/MIN  
94 - PVC2 PAIR\*  
95 - PVC2 RUN 5\*  
96 - PVC2 RUN 11\*  
97 - 1ST DEGREE BLK  
98 - 2ND DEGREE 1  
99 - 2ND DEGREE 2  
100 - 3RD DEGREE BLK  
101 - RIGHT BUNDLE  
102 - LEFT BUNDLE  
103 - NSR @80BPM  
104 - ATR FIB COARSE  
105 - ATR FIB FINE  
106 - VENT FIB COARS  
107 - VENT FIB FINE  
112 - PAROXYSMAL  
113 - SUPRAVENT  
116 - ATRIAL FLUTTER  
117 - SINUS  
118 - MISSED BEAT\*  
120 - NODAL  
121 - VENT @90BPM  
122 - VENT @120BPM  
123 - VTACH @140BPM  
124 - VTACH @160BPM  
125 - VTACH @180BPM  
126 - VTACH @190BPM  
127 - MISSED BT @80

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128 - MISSED BT @120  
138 - EMERGENCY 1  
139 - EMERGENCY 2  
140 - ELECTIVE CARDV  
141 - DEFIB NOW  
142 - DEFIB R SYNC

### PERFORMANCE

7 - SQUARE 2 Hz  
365 - SQUARE 2 Hz  
366 - SQUARE 0.125Hz  
367 - PULSE 1Hz 80ms  
368 - TRI 2Hz  
370 - SINE 0.05 Hz  
371 - SINE 0.5 Hz  
372 - SINE 1 Hz  
373 - SINE 10 Hz  
374 - SINE 25 Hz  
375 - SINE 30 Hz  
376 - SINE 40 Hz  
377 - SINE 50 Hz  
378 - SINE 60 Hz  
379 - SINE 100 Hz  
380 - HAVER WH 8mS  
381 - HAVER WH 12mS  
382 - HAVER WH 20mS  
383 - HAVER WH 40mS  
384 - HAVER WH 60mS  
385 - HAVER WH 80mS  
386 - HAVER WH 100mS  
387 - HAVER WH 120mS  
388 - HAVER WH 140mS  
389 - HAVER WH 160mS  
390 - HAVER WH 180mS  
391 - HAVER WH 200mS  
393 - HAVER A 0.05mV  
394 - HAVER A 0.1 mV  
395 - HAVER A 0.15mV  
396 - HAVER A 0.2 mV  
397 - HAVER A 0.25mV  
398 - HAVER A 0.3 mV  
399 - HAVER A 0.35mV  
400 - HAVER A 0.4 mV  
401 - HAVER A 0.45mV  
402 - HAVER A 0.5 mV

403 - HAVER A 0.75mV  
404 - HAVER A 1 mV  
405 - HAVER A 1.25mV  
406 - HAVER A 1.5 mV  
407 - HAVER A 1.75mV  
408 - HAVER A 2 mV  
409 - HAVER A 2.25mV  
410 - HAVER A 2.5 mV  
411 - HAVER A 2.75mV  
412 - HAVER A 3 mV  
413 - HAVER A 3.25mV  
414 - HAVER A 3.5 mV  
415 - HAVER A 3.75mV  
416 - HAVER A 4 mV  
417 - HAVER A 4.25mV  
418 - HAVER A 4.5 mV  
419 - HAVER A 4.75mV  
420 - HAVER A 5 mV  
421 - HAVER A 5.25mV  
422 - HAVER A 5.5 mV

### IBP

2 - BP ZERO  
3 - BP DYNAMIC  
5 - BP SENS 5 $\mu$ V  
6 - BP SENS 40 $\mu$ V  
151 - SAVE BP WAVES  
152 - BP SENS 5 $\mu$ V  
153 - BP SENS 40 $\mu$ V  
158 - BP ZERO  
159 - BP DYNAMIC  
160 - BP STATIC STEP  
161 - STATIC -10mmHG  
162 - STATIC -5mmHG  
163 - STATIC 0mmHG  
164 - STATIC 20mmHG  
165 - STATIC 40mmHG  
166 - STATIC 60mmHG  
167 - STATIC 80mmHG  
168 - STATIC 100mmHG  
169 - STATIC 120mmHG  
170 - STATIC 150mmHG  
171 - STATIC 160mmHG  
172 - STATIC 180mmHG  
173 - STATIC 200mmHG

174 - STATIC 240mmHG  
175 - STATIC 320mmHG  
176 - STATIC 400mmHG  
177 - BP DYNAMIC  
179 - BP1 ART 120/80  
180 - BP1 ART 90/40  
181 - BP1 AR 160/110  
182 - BP1 L VT 120/0  
183 - BP1 RT VT 25/0  
184 - BP1 LT AT 14/4  
185 - BP1 R AT 15/10  
186 - BP1 P AT 25/10  
187 - BP1 P WED 10/2  
188 - BP1 SWGNZ AUTO  
189 - BP1 SWGNZ MAN  
191 - BP2 ART 120/80  
192 - BP2 ART 90/40  
193 - BP2 AR 160/110  
194 - BP2 L VT 120/0  
195 - BP2 RT VT 25/0  
196 - BP2 LT AT 14/4  
197 - BP2 R AT 15/10  
198 - BP2 P AT 25/10  
199 - BP2 P WED 10/2  
200 - BP2 SWGNZ AUTO  
201 - BP2 SWGNZ MAN  
203 - BP3 ART 120/80  
204 - BP3 ART 90/40  
205 - BP3 AR 160/110  
206 - BP3 L VT 120/0  
207 - BP3 RT VT 25/0  
208 - BP3 LT AT 14/4  
209 - BP3 R AT 15/10  
210 - BP3 P AT 25/10  
211 - BP3 P WED 10/2  
212 - BP3 SWGNZ AUTO  
213 - BP3 SWGNZ MAN  
215 - BP4 ART 120/80  
216 - BP4 ART 90/40  
217 - BP4 AR 160/110  
218 - BP4 L VT 120/0  
219 - BP4 RT VT 25/0  
220 - BP4 LT AT 14/4  
221 - BP4 R AT 15/10  
222 - BP4 P AT 25/10

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223 - BP4 P WED 10/2  
224 - BP4 SWGNZ AUTO  
225 - BP4 SWGNZ MAN  
226 - RESP ARTIFACT1  
(5mmHg)  
  
227 - RESP ARTIFACT2  
(10mmHg)  
228 - RESP ART OFF

### RESPIRATION

423 - RESP SET LOW  
424 - RESP SET HIGH  
425 - RES RATE 0 B  
426 - RES RATE 15 B  
427 - RES RATE 20 B  
428 - RES RATE 30 B  
429 - RES RATE 40 B  
430 - RES RATE 60 B  
431 - RES RATE 80 B  
432 - RES RATE 100 B  
433 - RES RATE 120 B  
435 - APNEA 12 SEC  
436 - APNEA 22 SEC  
437 - APNEA 32 SEC  
438 - APNEA CONTIN  
440 - DELTA 0  $\Omega$   
441 - DELTA 0.05  $\Omega$   
442 - DELTA 0.1  $\Omega$   
443 - DELTA 0.2  $\Omega$   
444 - DELTA 0.5  $\Omega$   
445 - DELTA 1  $\Omega$   
446 - DELTA 2  $\Omega$   
447 - DELTA 3  $\Omega$   
448 - DELTA 4  $\Omega$   
449 - DELTA 5  $\Omega$   
451 - RATIO I/E 5/1  
452 - RATIO I/E 4/1  
453 - RATIO I/E 3/1  
454 - RATIO I/E 2/1  
455 - RATIO I/E 1/1  
456 - RESP VENT

### PACER

322 - ASYNC 75BPM

323 - DEMAND FREQ SI  
324 - DEMAND OCC SIN  
325 - AV SEQUENTIAL  
326 - NON CAPTURE\*  
327 - NON FUNCTION  
341 - PACE POSITIVE  
342 - PACE NEGATIVE  
343 - PULSE 2mV  
344 - PULSE 4mV  
345 - PULSE 8mV  
346 - PULSE 10mV  
347 - PULSE 12mV  
348 - PULSE 14mV  
349 - PULSE 16mV  
350 - PULSE 18mV  
351 - PULSE 20mV  
352 - PULSE 50mV  
353 - PULSE 100mV  
354 - PULSE 200mV  
355 - PULSE 500mV  
356 - PULSE 700mV  
358 - P WIDTH 0.1mS  
359 - P WIDTH 0.2mS  
360 - P WIDTH 0.5mS  
361 - P WIDTH 1mS  
362 - P WIDTH 2mS  
363 - PACE CAL

### TEMPERATURE

230 - TEMP 30°C  
231 - TEMP 35°C  
232 - TEMP 37°C  
233 - TEMP 38°C  
234 - TEMP 40°C

### CO

251 - INJ T1  
252 - INJ T2  
253 - INJ T3  
254 - INJ T4  
256 - C.O. BASE 36°  
257 - C.O. BASE 37°  
258 - C.O. BASE 38°  
259 - INJ TEMP 2°  
260 - INJ TEMP 20°

269 - C.O. 3 L/MIN  
270 - C.O. 4 L/MIN  
271 - C.O. 4.5 L/MIN  
272 - C.O. 5 L/MIN  
273 - C.O. 5.5 L/MIN  
274 - C.O. 6 L/MIN  
275 - C.O. 6.5 L/MIN  
276 - C.O. 7 L/MIN  
277 - CO TREND ON  
278 - CO TREND OFF  
279 - SLOW INJECT  
280 - FAULTY INJECT  
281 - L/R SHUNT  
282 - CAL 1°/1SEC  
283 - CAL 1°/4SEC

### FETAL SIMULATION

290 - FETAL RATE 60  
291 - FETAL RATE 90  
292 - FETAL RATE 120  
293 - FETAL RATE 150  
294 - FETAL RATE 180  
295 - FETAL RATE 210  
296 - FETAL RATE 240  
300 - FET AMP 0.1mV  
301 - FET AMP 0.25mV  
302 - FET AMP 0.5mV  
303 - FET AMP 1mV  
304 - FET AMP 2mV  
305 - FET AMP 3mV  
306 - FET AMP 4mV  
307 - FET AMP 5mV  
309 - UNIFORM DECEL  
310 - EARLY DECEL  
311 - LATE DECEL  
313 - IUP 0-25 mmHG  
314 - IUP 0-50 mmHG  
315 - IUP 0-100mmHG

### AUTO

480 - AUTO1  
481 - AUTO2  
482 - AUTO3  
483 - AUTO4  
484 - AUTO5



## **AMPS-1 OPERATING MANUAL**

485 - AUTO6  
486 - AUTO7  
487 - AUTO8  
488 - AUTO9  
489 - AUTO10

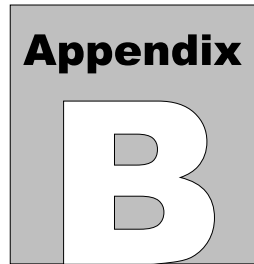
OPTION ENABLE

500 - ARRHYTHMIA  
501 - AED ARRHYTHMIA  
502 - ECG PERFORMANCE  
503 - RESPIRATION  
504 - TEMPERATURE  
505 - BP CH1 CH2

506 - BP CH3 CH4  
507 - PACER  
508 - CARDIAC OUTPUT  
509 - FETAL ECG/IUP

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

## **AMPS-1 OPERATING MANUAL**



## Appendix B - Accessories

### Standard Accessories:

- 3310-004: 9 Volt Alkaline Battery
- 6100-453: Operating Manual / *AMPSpc* companion software application on CD
- 3140-429: RJ-12 communication cable
- 3140-426: RJ-12 to DB-9 adapter

### Optional Accessories:

For a complete list of available accessories, visit [www.datrend.com](http://www.datrend.com) or contact Datrend Customer Service (see Chapter 16 for contact details)

