Arrow ACAT™ 2 Wave® Intra Aortic Balloon Pump

Features:
Converts the highly accurate arterial pressure from the fiber optic IAB catheter, FiberOptix™ series, to Aortic Flow on a beat-to-beat basis. Proprietary WAVE™ technology automatically inflates IAB to coincide with aortic valve closure. In the presence of an arrhythmia, initiates real-time, automatic R-wave deflation. Aortic Flow timing delivers the first truly intra-beat timing system based on individual patient physiology and virtually eliminating timing errors no matter how erratic the arrhythmia is. 2 modes of operation: Operator & AutoPilot™. One button start-up. Full color display with fast inflation and deflation speeds. Bellows / Stepper motor pneumatics with no maintenance required. Automatic scaling of ECG and pressures. Bright, clean display of all parameters, included assisted and unassisted pressures.

Specifications

Design
- FiberOptix™ capable: AP signal transmitted at speed of light
- Proprietary WAVE® algorithm
- Proprietary Aortic Flow Timing Method
- AutoPilot™ mode of operation
- Microprocessor-based system architecture
- Modular system consisting of display/control module and pneumatic drive unit
- Proprietary deflation timing management

Electrical
- AC requirements: 90–264 VAC 47–63 Hz
- Typical power consumption: 245 watts
- Maximum power consumption: 420 watts
- Battery operating time: 90 minutes minimum with full charge; 180 minutes with optional second battery
- Typical battery recharging time: 80% in 4 hours from full discharge; Recharge to 80% indicated by yellow light

Mechanical Dimensions
- Control module with monitor: 10" high (25.4 cm) x 13.75" wide (35 cm) x 2" deep (5 cm)
- Pneumatic drive unit: 31.5" high (80 cm) x 13.5" wide (34.3 cm) x 21" deep (53.3 cm)
**Mechanical Weight**
- Control module: 5 lbs (2.3 kg)
- Pneumatic unit for AutoCAT 2 WAVE®: 95.5 lbs (42.4 kg)
- Total weight for AutoCAT 2 WAVE: 100.5 lbs (44.7 kg)
- Total weight for AERO™ Series: 91.5 lbs (40.7 kg)

**Pneumatics**
- Drive system: Stepper motor-driven bellows
- Drive gas: USP-grade helium
- Helium tank: Disposable canister (500 psi) or refillable (2000 psi) cylinder—US Approval; (2900 psi) cylinder—European Approval
- Pumping volume: 0.5cc to 50cc, adjustable in 0.5cc increments
- Counterpulsation rate: 40 to 200 pulsations/minute
- Assist ratio options

**Condensation Removal**
- Thermoelectric system removes moisture continuously from pneumatic system without interrupting counterpulsation

**System Modes**
- AutoPilot: Automatically selects ECG/AP signal, sources, trigger mode, and timing method as well as timing settings; Automatically changes settings to optimize assist; Proprietary software sets timing to correspond to individual patient needs
- Operator: Allows user control of most pump functions

**Trigger Modes**
- ECG (PATTERN, PEAK, AFIB): Microprocessor-based R-waveform trigger detection algorithms
  - Pacer (VPACE, APACE): Low level (skin) ECG input
  - Pulse width 0.1 to 0.5 ms and pulse amplitude => +5 to +700 mV
  - Pulse width => 0.5 to 2 ms and pulse amplitude =>+2 to +700 mV High level (monitor) input
  - Pulse width 0.1 to 2 ms and pulse amplitude => 1 V
  - AV pacer detection is <250 msec between pacer pulses
  - Arterial pressure (AP): Microprocessor-based waveform trigger detection algorithm
  - Internal: Default to 80 bpm; adjustable 40 to 120 bpm
  - Filtering: Diathermy, 30 Hz low pass

**General Trigger Selection Criteria (AutoPilot Mode)**
ECG TRIGGER MODES:
- PATTERN: HR <130 bpm no arrhythmia
- PEAK: HR >130 bpm or arrhythmia detected and arrhythmia timing OFF*
- AFIB: Any HR with arrhythmia detected*
- VPACE: Single or dual pacer (<250 msec apart) and no QRS or AP waveform detected
- APACE: Single pacer with R-wave >100 msec later. Transition only AP TRIGGER MODE:
- No ECG signal or noisy ECG signal
  *Based upon deflation timing management.
Inflation/Deflation Timing Methods

INFLATION TIMING METHODS:
• Aortic Flow: Proprietary WAVE algorithm sets the timing intra-beat on average 1 ms of aortic valve closure
• Predictive: AP waveform analysis to set inflation
• Weissler: ECG only, inflation timing based on systolic time intervals

DEFLATION TIMING METHODS:
• R-wave: Real-time deflation on R-wave
• Predictive: Deflation set to occur just prior to next systolic rise
• Weissler: ECG only, deflation timing based on diastolic intervals

MANUAL:
• User set inflation and deflation timing in Operator Mode

Inflation/Deflation Timing Limits (Operator Mode)
• ECG: Inflation, 20%–80% of R-R interval; Deflation, 30%–120% of R-R interval
• AP: Inflation, 0–35% of peak systole-peak systole interval; Deflation, 35%–75% of peak systole-peak systole interval
• AFIB Trigger Mode: Inflation 80 to 430 ms after R-wave trigger event; Deflation on R-wave

Display
• Type: Color LCD flat screen
• Channels: Three-channel multicolor waveforms
  ° ECG: Green trace with white highlight on assisted portion
  ° AP: Red trace calibrated for direct reading of AP, white highlight on assisted portions when in Operator Mode
  ° Balloon pressure: Blue trace calibrated in mm Hg and displayed continuously
• Timing reference display: Numerical timing settings in both operating modes as well as a bar graph displaying inflate/deflate events in Operator Mode
• Cursor: Measurement of AP and balloon pressure waveforms

Alphanumeric Data
• Patient hemodynamics: Heart rate, AP—systolic, augmented, diastolic, and mean arterial. When in 1:2 or lower assist ratio the assisted values are displayed in white and the unassisted values are displayed in yellow
• Displayed parameters: ECG source and gain state, alarm status with timer, ON Battery indication, operation mode selection, AP alarm parameter and limit, timing settings, helium tank level, arrhythmia detection, and timing status
• Operations status: Operational mode, trigger mode, helium tank gauge, alarm/battery charge status, balloon volume
• Diagnostic alarm/help messages: Preprogrammed troubleshooting prompts/help

Strip Chart Recorder
• Recorder: Dual-channel dot matrix: Dot density 400 dots/inch, 25 mm/s
• Waveforms: ECG, AP, or balloon pressure (one or two recorded)
• Alphanumeric: Operational mode, trigger mode, ECG lead/source, AP source, AP alarm status, timing settings, assist ratio, balloon volume, timing method, arrhythmia status, alarm condition, date, time, patient hemodynamics

**Display Freeze**  
• Freezes approximately 7 seconds of patient data on screen

**Patient Signal Inputs**  
• ECG: 5 lead skin cable (I, II, III, aVR, aVL, aVF and V); High level monitor input (0 to 5 V)  
• AP: Fiber optic signal input from LightWave™ IAB Catheter (WAVE); AP transducer (Spectramed or equivalent), 50 mV/V/cm Hg; High-level monitor input (1 V = 100 mm Hg)  
Note: Additional system specifications are available from Arrow upon request.