MAX PULSE
FREQUENTLY ASKED QUESTIONS

HOW DOES THE MAX PULSE GET ITS READINGS FROM A FINGER PROBE?

Simplistically, the Max Pulse uses an infrared light finger sensor which implements LEDs as both light emitter and detector to measure one's pulse wave. A Pulse Wave occurs when the heart pumps and it generates a contour wave that travels along the arterial tree. The wave form is generated from the left ventricular chamber of the heart to the big aorta, and is reflected back when the big aorta bifurcates or divides into two arteries.

The Max Pulse then uses pulse-based signal conversion techniques and converts the wave into a digital signal. The digital signal can then be broken down using a variety of mathematical algorithms. Some of the algorithms that are used include Time Domain Analysis (TDA) and Frequency Domain Analysis (FDA). TDA measures the RR interval variation in the time domain. FDA uses the Fourier Transformation (FFT) to access the frequencies and amplitude of the oscillatory components hidden in the variability signal.

WHAT IS A PHOTOPLETHYSMOGRAPH?

Photoplethysmography measures one's pulse wave signal that indicates pulsation of the chest wall and great arteries followed by the heartbeat. The change in volume caused by the pressure pulse is detected by illuminating the skin with the light from an LED, then measuring the amount of light either transmitted or reflected to a photodiode. Each cardiac cycle appears as a peak. Photoplethysmographs have been around for over 25 years and are currently being used in many clinical applications.

Photoplethysmography is classified into two groups in terms of physical characteristics of parameters. One is "pressure Photoplethsmography", which represents the change of intravascular pressure. The other is "volume capacity Photoplethysmography", which indicates the change of vascular volume capacity.

Volume Capacity Photoplethysmography is then classified into three categories by signal processing method for velocity. The categories are Photoplethysmography (PTG), Velocity Pulse Photoplethysmography, and Accelerated Photoplethysmography (APG). The Max Pulse uses PTG and APG analysis.

The Max Pulse uses Volume Capacity Photoplethysmograph technology. Specifically, the PTG and APG applications for determining aging vascular health and Heart Rate Variability (HRV).

HOW DOES THE MAX PULSE MEASURE THE SYMPATHETIC AND PARASYMPATHETIC NERVOUS SYSTEMS?

When a person's pulse wave information is collected, the Max Pulse uses Frequency Domain Analysis (FDA) to gather the three different frequencies of the Autonomic Nervous System: VLF (Very low frequency) - 0.0033-0.04Hz, LF (low frequency) - 0.04-0.15Hz (Also known as "Mayer" waves), and HF (High frequency) - 0.15-0.4Hz (Vagus Nerve). Next, the frequencies are then used to see if they are in the normal ranges by using the following formulas: LF norm = LF / LF + HF - > Sympathetic nerve and HF norm = HF / Lf + HF - > Parasympathetic nerve. Finally, depending on the information gathered, a LF:HF ration is determined and then plotted to show how the Sympathetic and Parasympathetic nervous systems are working in conjunction with their norm and each other (normal (balanced) or hyper or hypo to their norms).

HOW ACCURATE ARE THE READINGS?

The Max Pulse is used extensively in Asia. The parent company (Medicore) uses the Max Pulse in conjunction with 8 University Research Hospitals in Seoul, Korea. As a result, studies show that the Max Pulse has a + accuracy of 2% for the measurements it captures.

IS THE MAX PULSE FDA APPROVED?

Yes, after three years of review by the FDA, the Max Pulse was approved on June 16, 2011 as a Class II Medical Device.

HOW COME I HAVE NOT HEARD OF THE MAX PULSE BEFORE?

Plethysmography technology has been around for over 25 years. It has been used for different applications. It has been a growing science over the last few years specifically because of its significance in being a non-invasive simple test for determining Heart Rate Variability (HRV) and Aging Vascular Health. Since the Max Pulse obtained FDA approval June 16, 2011, The Cardio Group is using advertising campaigns, conferences, continuing education, conventions, referrals and a dedicated sales force, to get the word out to the health care industry.

Max Pulse Definitions

Accelerated Plethysmograph (APG): APG test measures the blood circulation state and aging level of blood vessels in regards to vascular elasticity and hardening, through the signal at the finger tip. APG is also called the "final analysis" wave form. APG uses the second derivative of the waveform of the digital photo-plethysmograph to stabilize the baseline and to separate components of the waveform more clearly and distinctly.

Arterial Elasticity (AE): Analyzes the blood circulation, the vascular elasticity and resistance of the vessels. It detects early cardiovascular disease like atherosclerosis and peripheral circulation dysfunction. AE analyzes the c/a value out of the basic waves. It means the elasticity of arteries and if the elasticity is bad, its value moves from (+) value to (-) value.

Differential Pulse Wave Index (DPI): Represents the overall health of the cardiovascular system. DPI is the main indicator that represents the aging of arteries. => - b + c + d / a. It means if the (-) value is lower, the vascular aging degree is going bad.

Eccentric Constriction (EC): Represents the contraction power of vessels from the left ventricle. EC analyzes the b/a value out of basic waves. If the cardiac output is higher, the vascular state is good and the result value should be bigger in (-) value.

Frequency Domain: The HRV is comprised of multiple frequencies. Frequency domain method analyses this waveform by looking at the different frequency components of the waveform. The two main frequency components that represent ANS activity are the low frequency (LF) components (0.04 to 0.15Hz) and the high frequency (HF) components (0.15 to 0.4 Hz). Frequency domain measures confirm that the LF and HF oscillatory components are relative indices of cardiac sympathetic and vagal activity respectively and HF and RMSSD indicate parasympathetic activity.

Heart Rate Variability (HRV): HRV is the degree of fluctuation in the length of intervals between heart beats. HRV measures the overall health status and the autonomic nervous system function that is composed of sympathetic nerve system (SNS) and parasympathetic nerve system (PNS). SNS plays a role of an accelerator in our body while PNS is functioning as a brake. If one of them is broken, it will be easier to get cardiovascular diseases as ANS is not balanced. Heart rate is determined by the SA Node and ANS (Autonomic Nervous System) function. For healthy people, HRV shows complicated and irregular heart rates while unhealthy people have simple and regular heart rates. HRV has attracted much attention and has been researched in relation with various conditions and diseases in more than 7,000 copies in Pubmed. You can search the Pubmed site at: (http://www.ncbi.nlm.nih.gov/Pubmed).

HF: High Frequency (0.15 to 0.4HZ) See Frequency Domain.

LF: Low Frequency (0.04 to 0.15HZ) See Frequency Domain.

Parasympathetic Nerve System (PNS): The PNS is responsible for stimulation of Activities that occur when the body is at rest ("Rest and Digest") including sexual arousal, salivation, lacrimation (tears), urination, digestion, and defecation. The PNS functions as a break in the ANS.

Plethysmograph (PTG): The "basic" wave form signal that indicates pulsation of chest wall and great arteries followed by heart beat. It measures the changes in blood volume within an organ or whole body.

Power Spectrum Analysis: Power spectrum analysis of the heart rate fluctuations provides a quantitative noninvasive means of assessing the functioning of the short-term cardiovascular control systems. The sympathetic and parasympathetic nervous activity makes frequency-specific contributions to the heart rate power spectrum.

Remaining Blood Volume (RBV): It is the remaining blood volume in the vessels after systolic contraction on the heart. If the blood vessels are healthy, there is little remaining blood volume. RBV analyzes the d/a value out of the basic waves. If the vascular state is better, the remaining blood volume will be lower and it describes (-) value. But, if the aging degree is in progress, EC will be weakened and RBV will remain high. It is an important indication of classifying the wave type.

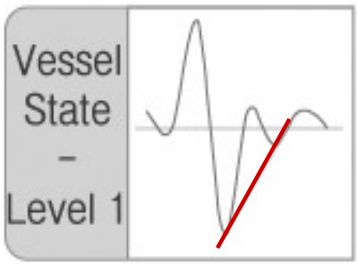
Sympathetic Nerve System (SNS): Its general action is to mobilize the body's resources under stress; to induce the fight or flight response. It is however constantly active at a basal level to maintain homeostasis. SNS plays a role of an accelerator in the Autonomic Nervous System (ANS).

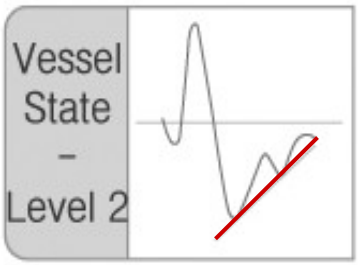
TP: Total Power is the combination of the three frequencies (VLF, LF, and HF).

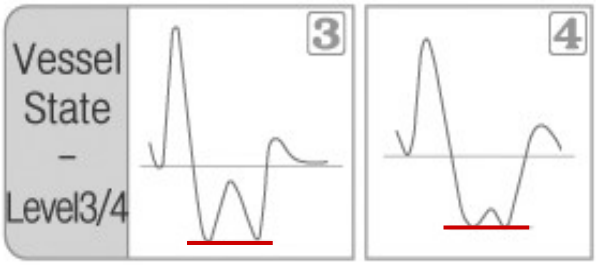
VLF: Very Low Frequency.

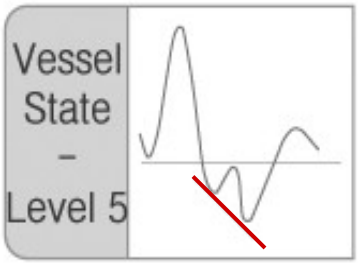
Waveform Types & Arterial Progression

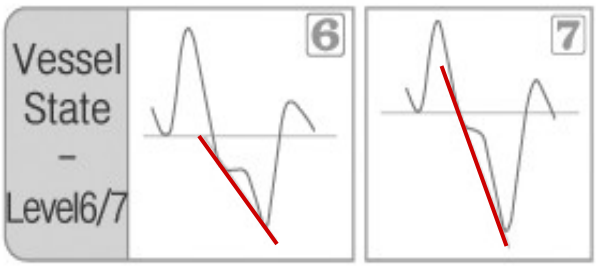
Waveform Patterns











Arteriosclerosis Progress

Blood circulation and artery state is ***great***!

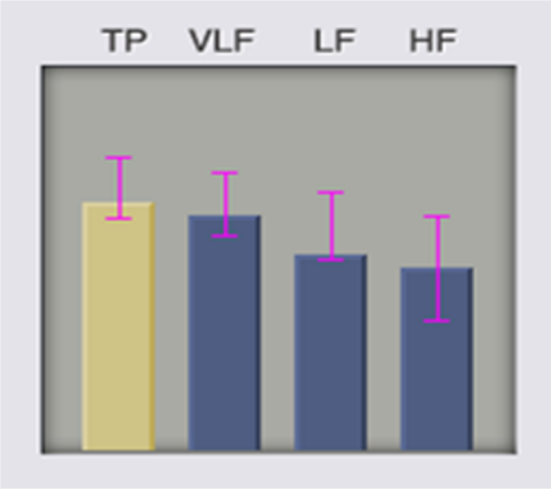
Blood circulation and artery state is ***good*** but a slight build up is beginning to occur.

Blood circulation and artery state is becoming ***poor*** and build up is starting.

Blood circulation and artery state is ***bad*** and build up is increasing.

Blood circulation and artery state is ***very bad*** and build up is becoming serious.

Healthy



Unhealthy

Reduction of TP	Reduction of VLF	Reduction of LF	Reduction of HF
∗Decreased ANS function ∗Lowered regulation competence ∗Decreased ability to cope with the requirement of continuously changing environment	∗Lessen the ability of body temperature regulation ∗Hormone disorder	∗Loss of energy ∗Fatigue ∗Insufficient Sleep ∗Lethargy	∗Chronic stress ∗Aging ∗Reduced electrical stability of heart ∗Functional indigestion