

Ankle-Foot Prosthesis Simulator

Efficient and accurate ISO/DIS 22675 tests

Recent data from the Amputee Coalition of America indicates that approximately 2 million people suffer from major limb loss within the USA, and new amputations are growing at the rate of 185,000 per annum. The need to develop comfortable, durable and agile limb replacements has become a major priority in the biomedical industry. Shore Western has developed an Ankle-Foot Prosthesis Simulator with innovative kinematics and controls technology that can accurately replicate the loading profile of a walking leg.

The servohydraulic two axis simulator uses closed loop displacement control for the angular movement of the tilting platform, and mixed mode control for the axial load. Mixed mode is a powerful control technique that enables dynamic and accurate load programming while using a safer and more stable displacement control. This is made possible with our proprietary Real Time Active Control technique; a unique and powerful optimization algorithm that faithfully reproduces the desired waveform.



Axial loads are available up to 6.8kN (1.5kip) to allow testing to the P6 level. The tilting platform can produce 960Nm (8,500inlbs) of torque and has a total range of motion (ROM) of 70° (-25° to +45°). The tilting platform has changeable heel blocks to preserve the optimum heel height and the specimen holder has adjustable spring rates to return the foot to home after toe-off, its anterior to posterior slope is adjustable $\pm 5^\circ$ from the transverse plane. Test cycle speeds of 1.5Hz are achievable and can run 24 hours a day seven days a week with immediate specimen failure detection.

Shore Western can also supply our industry acclaimed Whisperpak® hydraulic pump to complement the system. These pumps provide clean, full flow, conditioned oil at 210bar (3000psi) with less than 70dB of noise.

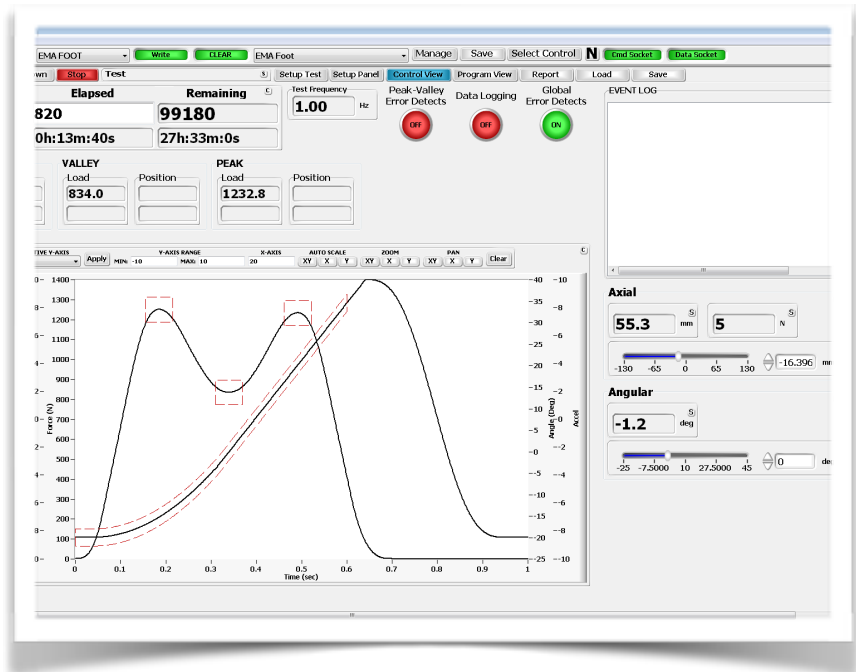
Control System

The Ankle/Foot control system is based on the Shore Western SC6000 platform, running in a Windows® 7 environment.

The application software is specifically designed to run an ISO/DIS 22675 test. Our proprietary Real Time Active Control (RTAC) algorithm through mixed-mode control is able to learn the system behavior and adapt to control the non-linear response, matching the desired waveform. The user enters their desired curves for angle and load. An integrated accelerometer compensates for the errors caused by the moving load cell.

Error bands can be defined for any section along the angle curve. Error boxes can be synchronized with the gait

points of heel-strike, mid-stance, and toe-off for the load curve. In addition, the displacement of the vertical actuator is monitored for stiffness changes during the test. Should the response signal fall outside these limits, the system can be stopped, allowing early detection of damage to the specimen.



Features

- A precise servohydraulic system with our proprietary Real Time Active Control (RTAC) mixed mode algorithm reproduces the foot load while running the actuators in displacement and angle control.
- Axial Load (Fz) up to 6800N (1500lb), to support loading levels to P6 with 150mm of axial travel.
- A tilting foot platform that produces up to 960Nm (8,500inlb) of torque, with a total range of motion (ROM) of -25° to +45° from horizontal. The table can also be locked at +20° and -15°.
- Changeable heel blocks to preserve the optimal heel height
- A specimen fixture with an adjustable spring rate to return the foot to its home position after toe off, combined with an adjustable anterior to posterior slope of $\pm 5^\circ$ from the transverse plane.
- Fatigue rating to 9.8kN (2.2kip)
- Speeds up to 1.5Hz
- An open frame design that allows ease of sample installation and inspection, with a compact footprint of 610mm (24in) x 735mm (30in) wide x 2515mm (99in) high.
- 24/7 operation is possible with sophisticated specimen failure detection, and reliable uptime.

Options

- Protective Lexan shields that cover the entire open areas to contain ruptured material on failure
- Calibration fixture with load cell to calibrate the Fz transducer.