

In order to express the muscular activity of a muscle as the percentage of the MVC of that muscle, the measurement of EMG signals associated with the MVC EMG was conducted before the kicking trial began (Figure 5 and 6). The MVC EMG was employed in the later calculation of %MVC, which represented the muscular activities of the selected muscles.

**Figure 5.** The figure shows the test of isometric maximum voluntary contraction with knee flexion.

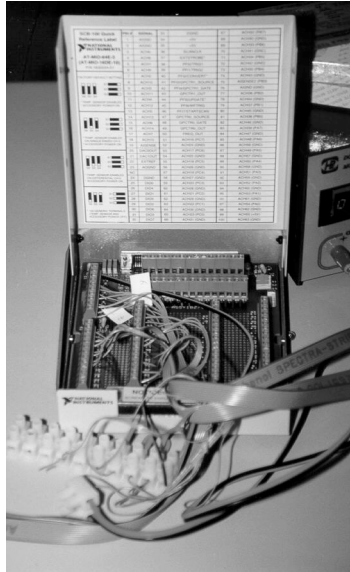


**Figure 6.** The figure shows the test of isometric maximum voluntary contraction with knee extension.

During the collection of EMG signals, the signals from the electrodes were pre-amplified, and transmitted through telemetric radio transmitters (915 Transmitter Unit, TELEMG, Italy). These signals were received by the receiving unit (920 Diversity Data Receiver, TELEMG, Italy), and passed through the optical fibre to the main unit. The main unit then amplified the signal by 1000 times.

The quantitative analysis of the EMG signals was performed by an IBM-compatible computer. The raw EMG signals were low-pass (600 Hz) and high-pass (10 Hz) filtered and simultaneously A/D-converted (PCI-6071E, National Instruments, USA) at a sample rate of 2000 Hz for each channel. The rectification of EMG signal and

integration of EMG signal were calculated by data acquisition and analysis software (LabView, USA), with simultaneous visual control of the signals on the computer display.



**Figure 7.** The figure shows the connection box between the A/D converted card and signal from the instruments.

The information provided by EMG signal analysis included the degree of contraction of the selected muscles and the priority of muscle recruitment during kicking. This important information was then used in the design of the training protocol.