

**TecnoBody**<sup>TM</sup>  
Rehabilitation Systems



Distribution



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Rehabilitation Systems



Multi-Joint System

# Multi-Joint System MJS

Because of its complexity, the shoulder joint has always fascinated the world of rehabilitation. It is the most complex joint in our body, both in as far as joint-freedom range and muscular-tendon structure responsible for control and stability, are concerned.

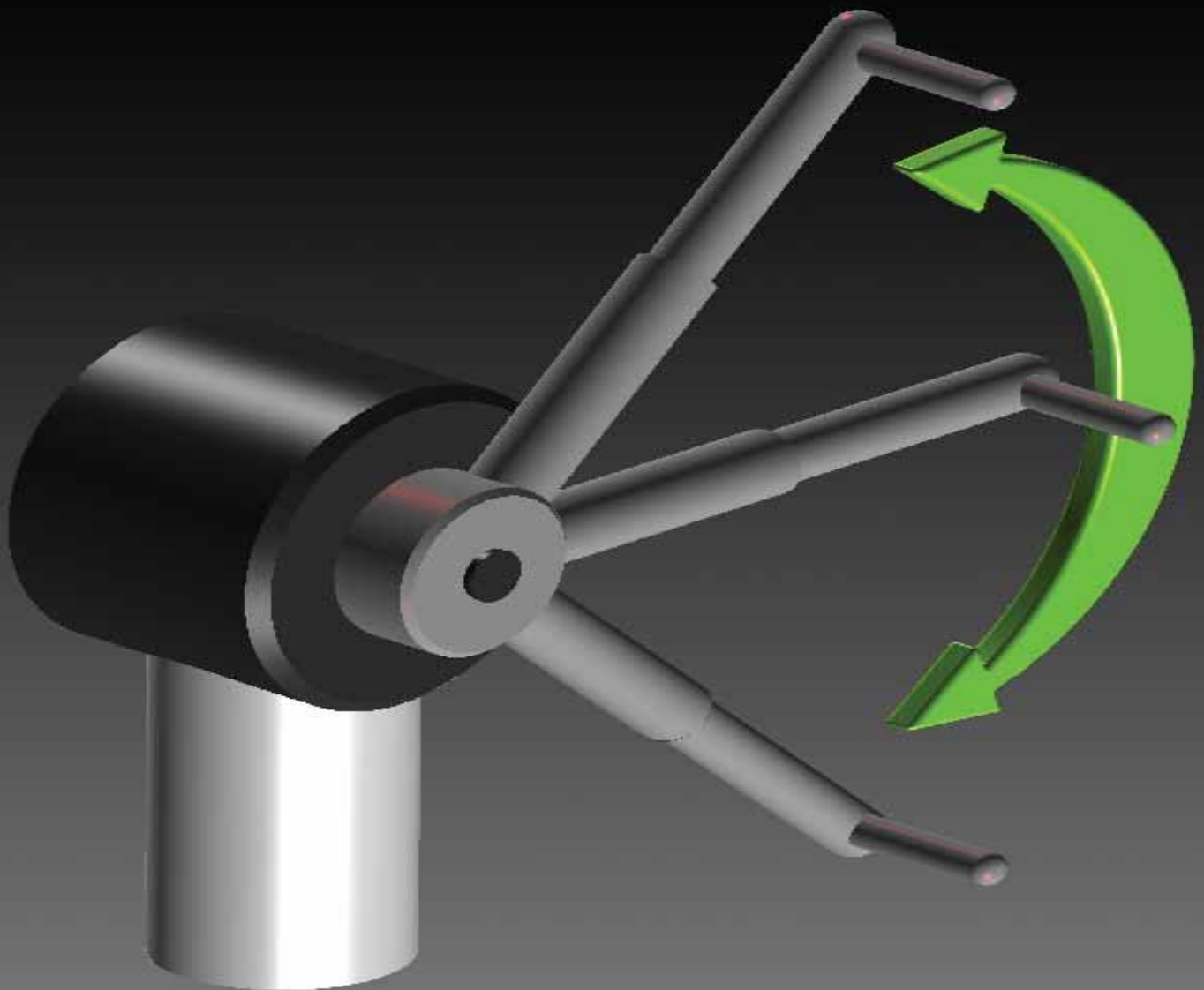
Clinical opinion stating that the fundamental role of perceptive exploration by the hand is strongly penalised in the presence of shoulder deficiency, is now consolidated.

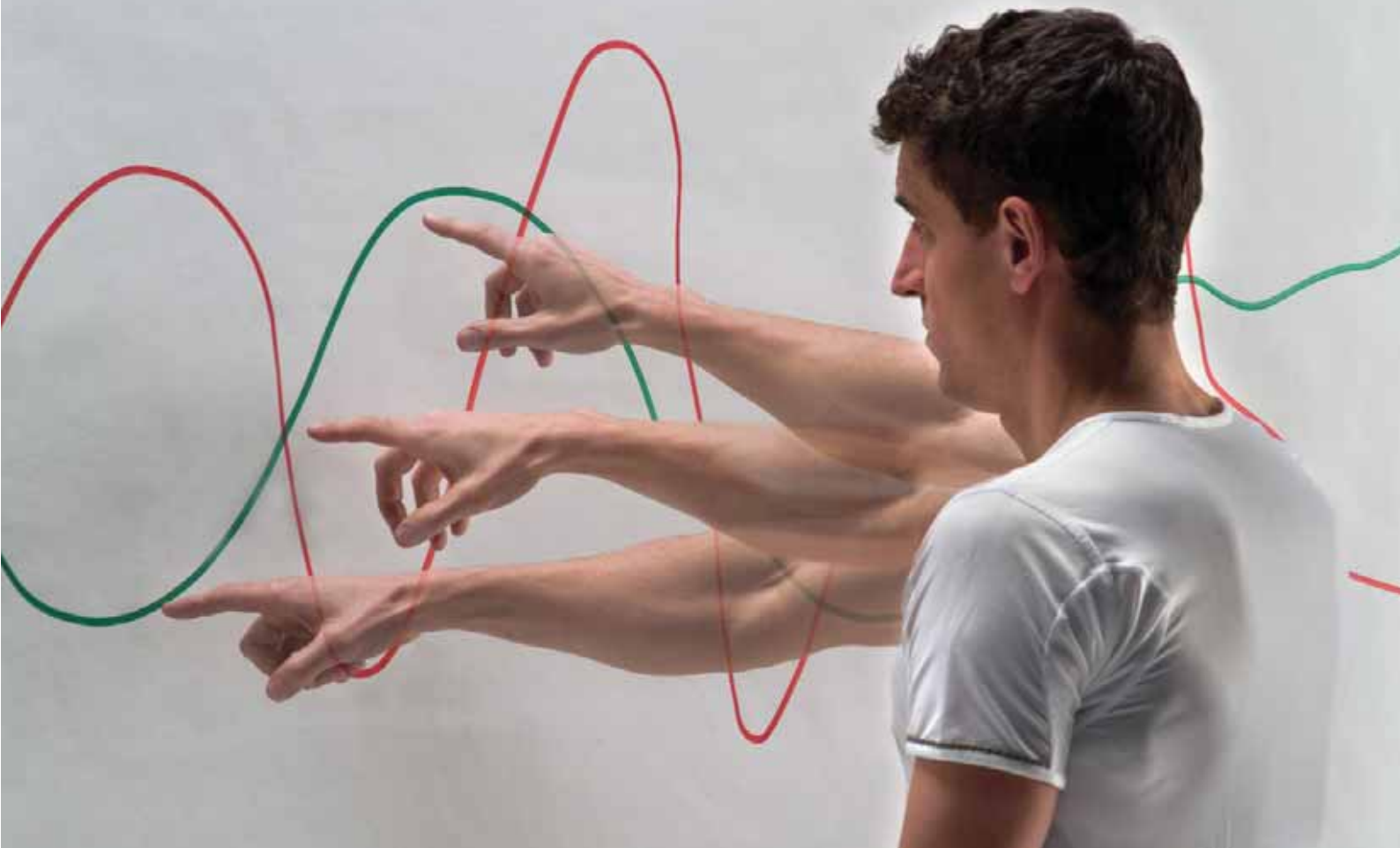
In fact, due to its position between the centre of our body (i.e. the chest considered as the reference point) and the distal part (hand), the shoulder represents a perceptive fulcrum of

fundamental importance. With its abundance of proprioceptive sensors, the shoulder controls and coordinates all the movements of the body's upper limb with a three-dimensional type of perceptive exploration.

Over the past few years, quite a number of companies have endeavoured to develop assessment/rehabilitation systems for the shoulder, starting out from the classic mechanical concept involving only one rotation axis. This approach has a very simple explanation, when one realises that many rehabilitation machines have been designed for knee joint rehabilitation (for essentially a one rotation axis joint) and then adapted to

\*meccanica monoassiale





the upper limb. It is useful to think that this mechanical arrangement problem is present in all systems available nowadays, no matter which force adjustment system is implemented (isotonic, passive mobilisation, isokinetic).

Over the last ten years, the affirmation of neurorehabilitation has provided further evidence of this mechanical arrangement problem common to many rehabilitation systems.

The loss of perceptive information due to damages to the C.N.S. (hemiplegia) or partial loss due to local afferential reduction (prosthesis) necessarily imply rehabilitation focused on perceptive exploration.

Lately therefore, there has been a proliferation of many aids designed to help patients follow specific trajectories with the purpose of providing perception of complex movements in free joint spaces, without mechanical limitation and as similar as possible to the true biomechanical nature of the shoulder itself.

With an eye on the usefulness of free shoulder movements, rehabilitation methods in water have also affirmed themselves. In fact, this methodology

basically offers three advantages: freedom of movement, partial relief of the weight of the arm at low movement speeds, muscle and ligament strengthening at medium/high movement speeds.

The considerable limitation of the perceptive arrangements implemented up till now, i.e. either the use of predetermined trajectories or water rehab, is that nothing can be exactly quantified and therefore assessed correctly.

In light of the above, it is hereby evidenced that the treatment and evaluation or assessment of the shoulder and the upper limb in general, require a "global" type of rehab arrangement.

With this definition we mean a rehabilitation / evaluation and assessment approach that is careful of both the strictly mechanical issues as well as the neuroperceptive issues involving the shoulder.

Which is exactly why we have developed our Multi-Joint System.

# Multi-Joint System





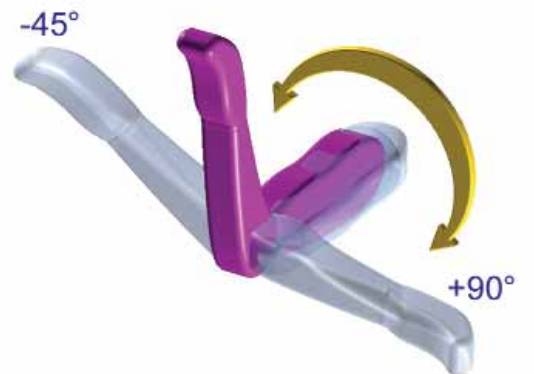
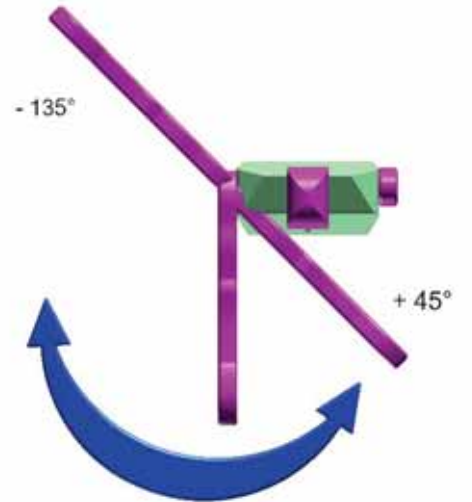
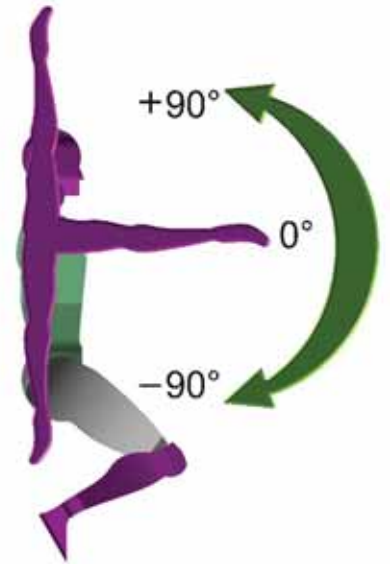
# Freedom of movement

The arm of the Multi-Joint System, that is positioned so that it is parallel to the patient's limb, is actually a good and proper anthropomorphic arm, engineered according to the principles of cybernetics.

As it is provided with four "freedom" ranges, this mechanical arm gives the patient freedom of joint-movement in a three-dimensional joint-space. Simultaneously, every single movement is detected.

As in the past, the patient is required to follow predetermined trajectories on a computer screen in order to be able to explore the most complex joint movements but, in addition, the movements will be traced and recorded for subsequent assessment and comparison with a set of reference indexes, that will help the operator to build up a correctly personalised rehabilitation protocol.







MJS

TecnoBody

# Control over force

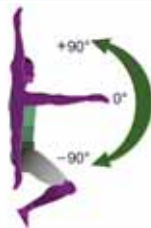
The three fundamental axes of movement (Anterior-Posterior, Adduction-Abduction, Internal rotation-External rotation) are much too important to be controlled and adjusted with the same force intensities.

The muscles that are responsible for the anterior-posterior movement of the shoulder, such as the deltoid or the biceps brachii muscle, develop a force that is by far inferior compared to the muscles that are responsible for Adduction-Abduction movement (e.g. the pectoralis major muscle).

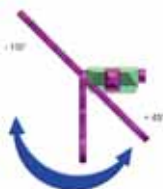
Therefore, in order to differentiate the intervention modes on the different muscle sections correctly and also in order to expand the MJS implementation potential, the MJS has been provided with three, completely independent force control and adjustment units. One unit is for Anterior-Posterior movements, one is for Adduction-Abduction movements and, finally, one is for Internal rotation-External rotation of the shoulder.

For monitoring completeness, without any compromise to the perfect control of motorial exercises.

F2



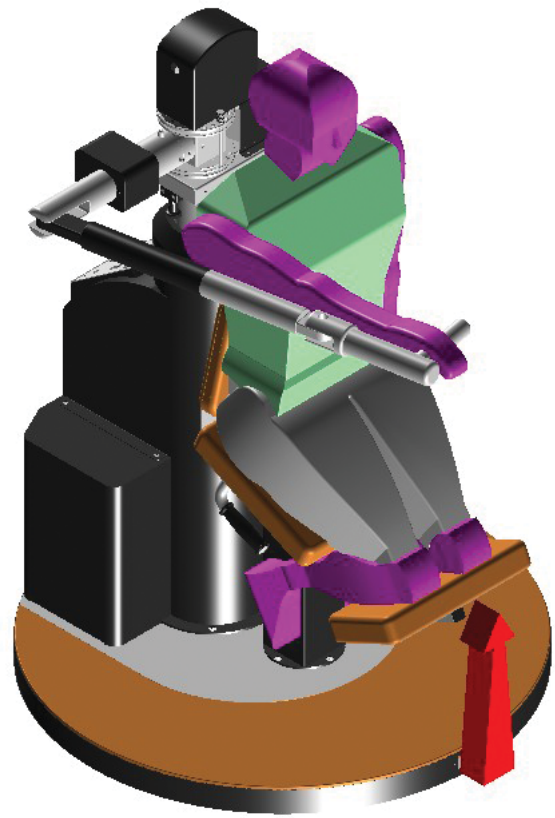
F1



F3



# Light-G for load-free exercise



The Light-G function is particularly useful, as it enables the decreasing of individual arm weight, at joint-level. The system in fact develops a thrust that goes from down pushing upwards, which enables the patient to explore specific joint spaces, even during acute phases.

Such rehab methods are often used in water where the patient is subject to a hydrostatic force exerted by the submersion of the body. Based on the same principle, the MJS helps the operator to adjust the push of the thrust supplied by the system based on the muscular effort that the patient is required to exert.

In this compensation mode of the set load, the weight of the arm can be totally cancelled. By doing so, the shoulder joint will be completely "lightened" and the patient can enter an initial phase of perceptive exploration, at "no-load".

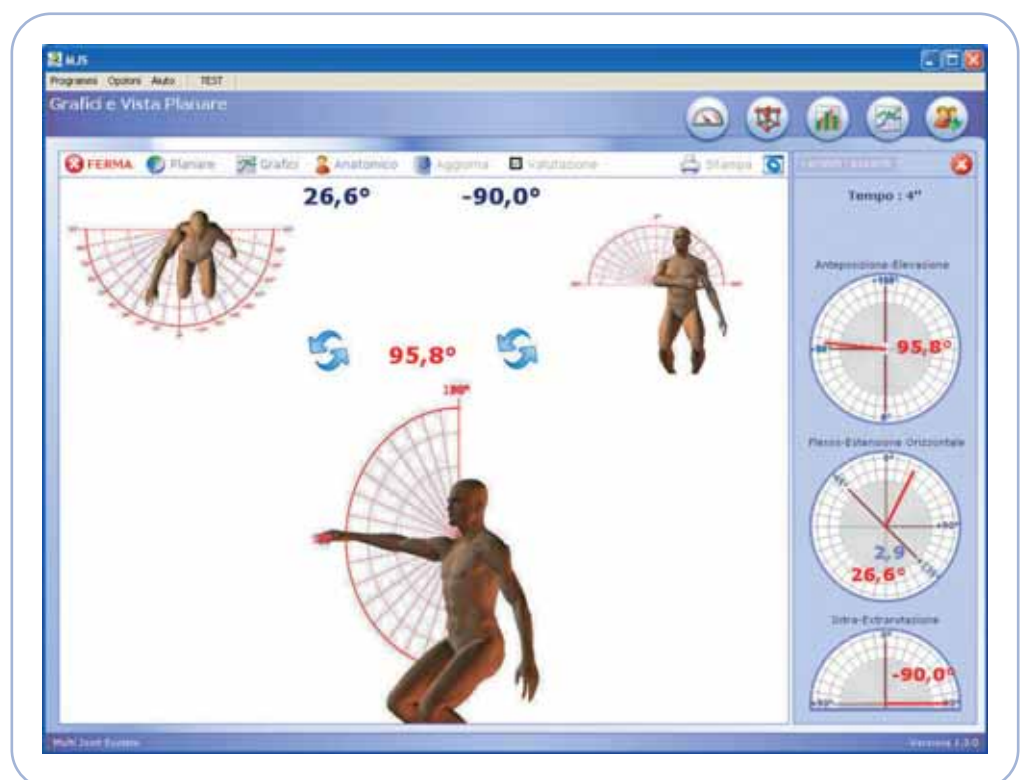


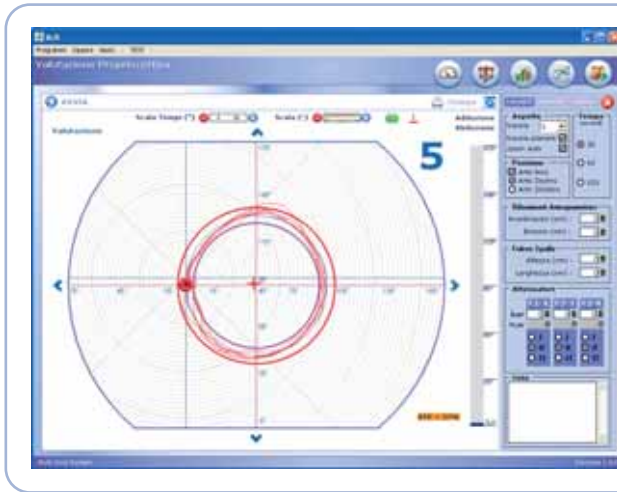
# Software MJS



After an initial assessment phase, the system software applications enable the operator to select specific "Rehab Tracing" functions, that can make the "Global" rehab approach considerably easier. Similarly to previous system processes, the operator here can draw specific-movement rehab tracings on the computer screen,

designed within completely free, three-dimensional joint spaces. In this way the patient, by real time comparison of his individual track-performance tracings against the reference tracing, is given some powerful feedback that will help to fine-adjust the patient's movements considerably.

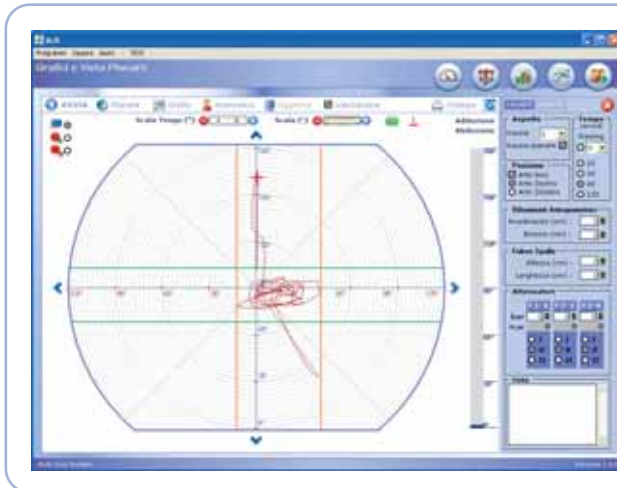




## Assessment Module

The Assessment Module provides for three-dimensional exploration of the shoulder, related to the range of motion that is detected.

The test gives the operator a set of indicators such as proprioceptive sensitivity, joint mobility and the developed strength in isometric mode.



## Flat View and Graphics Module

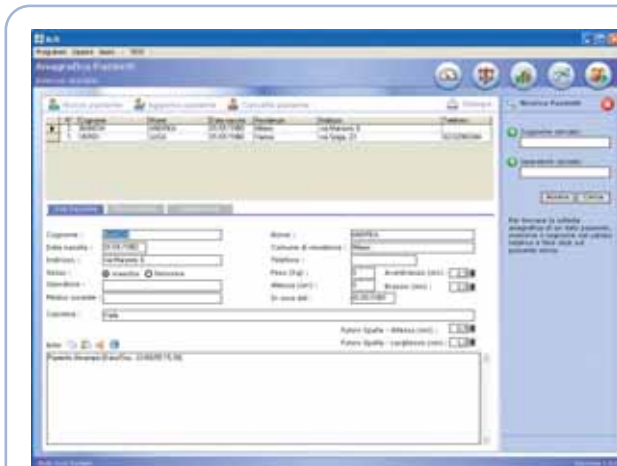
This program module gives a clear and legible display of the three-dimensional movement of the shoulder, either in flat-view mode, in graphic mode or in anatomic mode. The fact that during the joint exploration process the patient has the option of signalling the points of pain by pressing on the "pain pushbutton", is particularly useful.

The coordinate data of the points of pain are stored by the system and can be accessed at later dates for further verification.



## Rehabilitation Tracing Module

The Rehabilitation Tracing module is also particularly useful both for correct proprioceptive training sessions and for accurate, local assessments. The coloured spheres represent the compulsory or enforced transit points (Joint Position Sense), whereas the red line represents the ideal kinaesthetic path. The program provides continuous display of the gap between the ideal kinaesthetic line and the patient's trace line. In this way, the patient's proprioceptive sensitivity is quantified.



## Patient Data Module

The Patient Data program module is the data file processing nucleus of all the test session data records.

In fact, here it is possible to manage both the patient's Medical Record Card data as well as all the test session data records previously stored into the system, immediately and intuitively, via simple program functions.

# Technical data

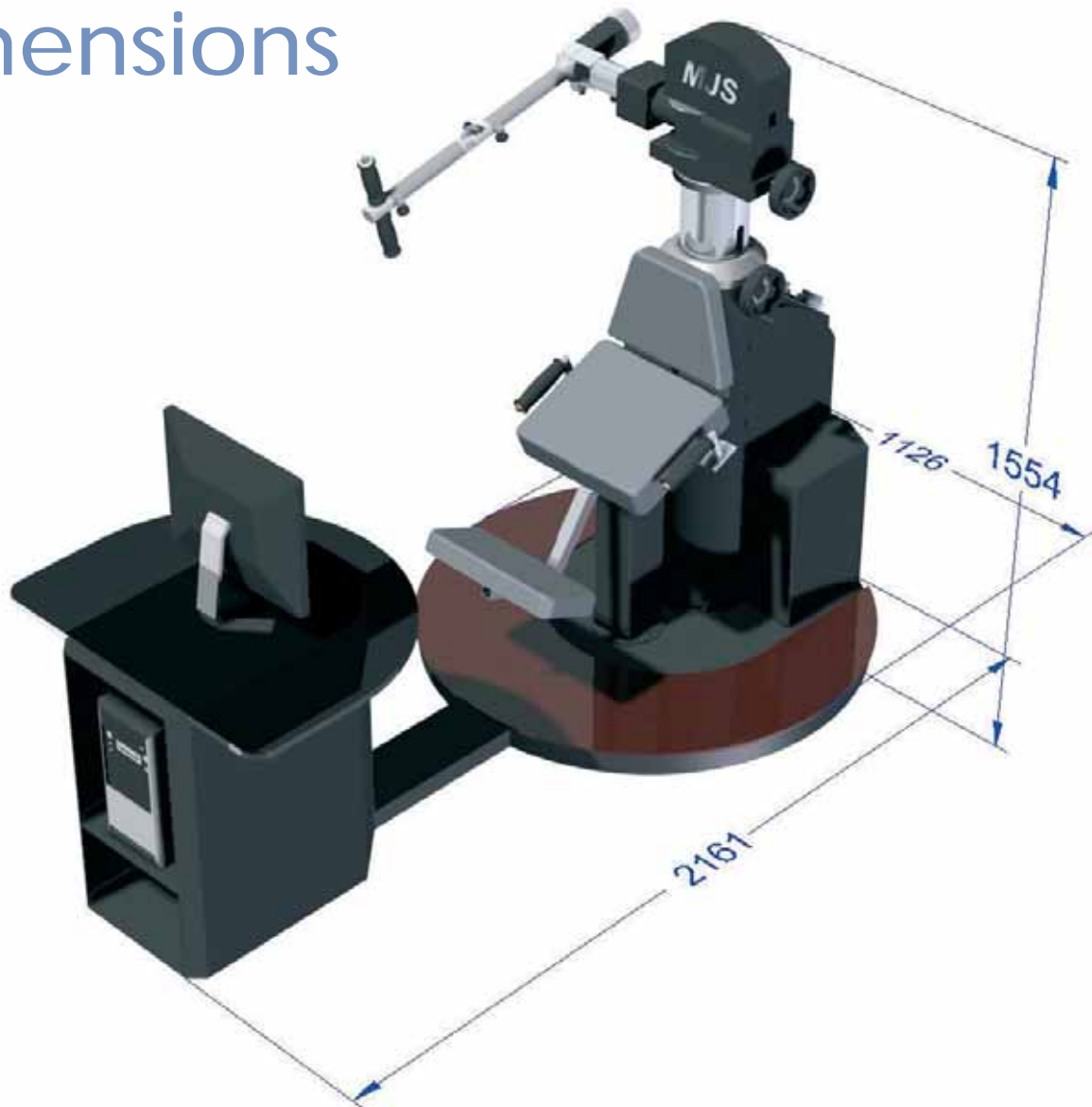


Mod. MJS 403 plus



Mod. MJS 403

# Dimensions



## Technical Specifications

ELEVATION	0° - 180°	RESOLUTION 1/10°
ADDUCTION-ABDUCTION	0° - +180°	RESOLUTION 1/10°
FLESSO - HORIZONTAL FLEX - EXTENTION	-45° - +120°	RESOLUTION 1/10°
INTERNAL - EXTERNAL ROTATION	-90° - +20°	RESOLUTION 1/10°
F1 ELEVATION	50 Nm α 100 PSI	RESOLUTION 1 Nm
F2 ADDUCTION-ABDUCTION	50 Nm α 100 PSI	RESOLUTION 1 Nm
F2 INT. ROT., EXT. ROT.	30 Nm α 100 PSI	RESOLUTION 1 Nm
SAMPLING FREQUENCY	20 Hz	
POWER SUPPLY	24 VL DC	
PC INTERFACE	RS 232	