COR1 – Knee Dinamometer

The COR1 is a knee dinamometer. It based on a load cell and it can measure force during flexion or extension The knee joint torque is obtained by multipling the force detected by the load by the known and fixed lever arm.

Leg Positioning

The leg has to be placed in the dinamometer and the positioning system (see Fig. 1) can be moved to fit the most confortable position for the subject.

Fig. 1. *The dinamometer COR1. A: adjustable plate where the leg is positioned and fixed. B: anchoring blade. C: seat sliding system. D: seat with belts.*

For reliable measurements it is important that the knee center of rotation is aligned with the dinamometer center of rotation (see Fig. 2). In case it is possible to adjust the position of the chair by means of a sliding system and an electric motor to align the knee to the dinamometer.

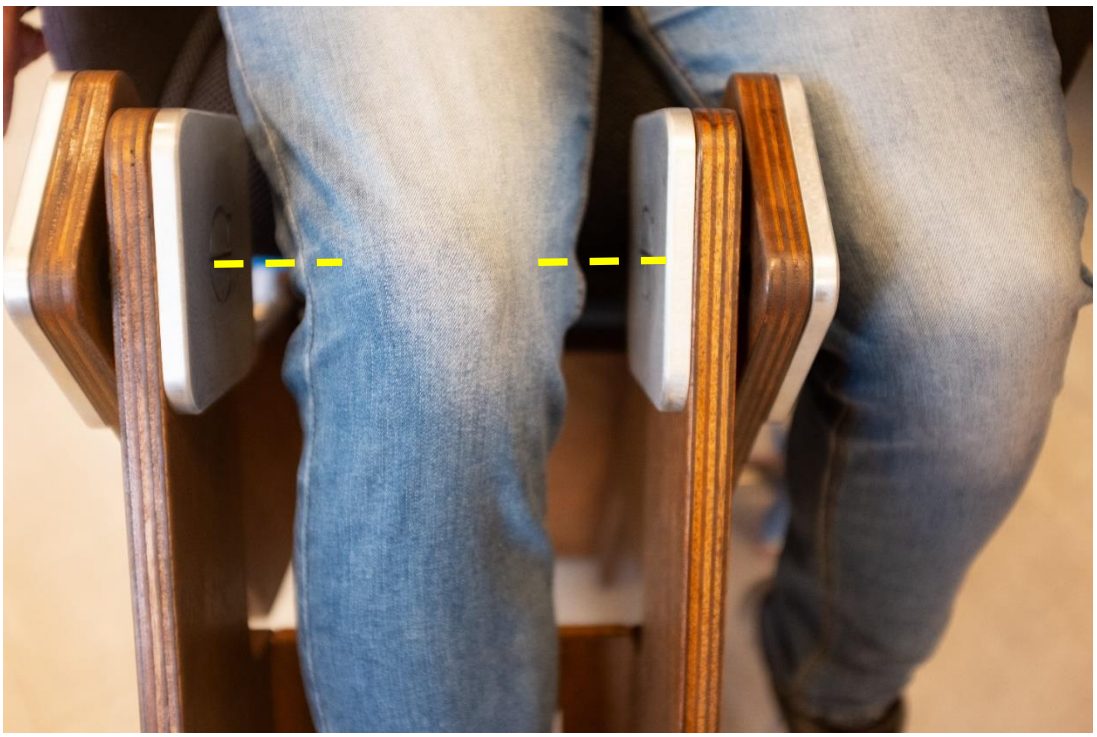

Fig. 2. *Alignment between knee and ergometer centers of rotation.*

The leg has to be fixed using straps or bands. The footplate has two cuts to allow the fixation of the leg (Fig. 3).

Fig. 3. *Fixation system.*

The angle can be changed between 90° and 170° (in 10° steps) by sliding the anchoring blade of the platform (see Fig. 4) and fixing it with the special awl (Fig. 5).

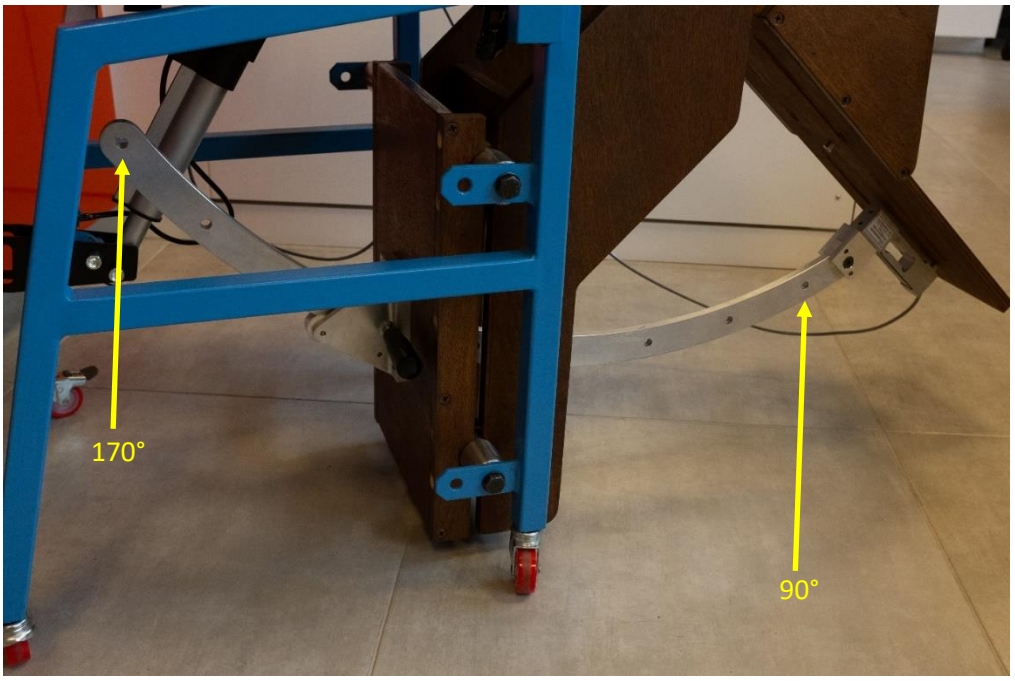

Fig. 4. *Knee angle setting awl.*

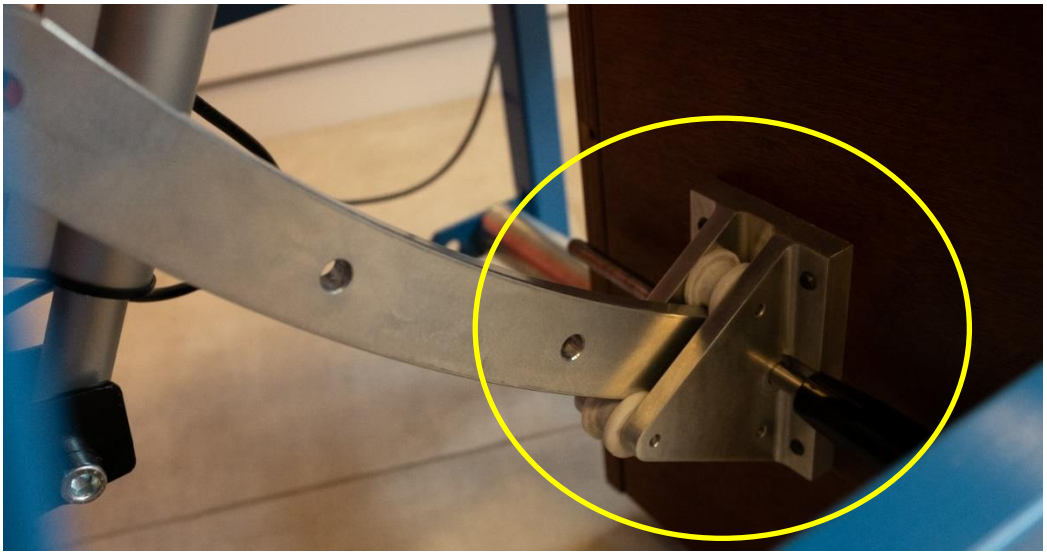

Fig. 5. *Tilt angle fixing system.*

Use COR1 with forza, forzab and forzaj devices

Forza, Forza-b and Forza-j have been designed to be used as a force measurement device for signal produced by load cells or torquemeters with differential output.

Forza and Forza-b are designed as two accessories of the Quattrocento device while the Forza-j has been designed as an accessory to the Sessantaquattro device.

In all three cases, the following steps must be followed to use the accessory:

- Connect the dynamometer connector to the forza device using the Load Cell Input.
- Connect the device to an acquisition system using the cable called J-BNC cable.
- Adjust the gain of the system using the button/wheel Gain Select.
- Delete the offset using the button Offset.

Fig. 6. *Forzab, forza and forzaj load cell amplifier.*

To calculate the force from the raw data in Volts it is necessary to use the following function:

$$\text{Force [kg]} = \frac{V_{out\ measured}\ [V] * F.S.\ [kg]}{\text{Sensibility [mV/V]} * 5\ [V] * \text{Gain [V/V]}}$$

Where:

- F.S. = Full-Scale, it is indicated on the load cell;
- Sensibility = depends on load cell;
- Gain = depends on how to use, in PC use it's sets on SW, in analog use it's sets with the Gain button.

When using OT BioLab + it is necessary to provide a scale factor, a factor that regulates the conversion between the input force (or torque, angle, speed ...) and the voltage at the input of the auxiliary input. Therefore, for the load cell and its amplifier the scale factor can be estimated as:

$$SCAL_{FACT} = \frac{1000\ x\ LC_{FS}}{LC_{SENS} x\ LC_{SUP} x\ FA_{GAIN}}$$

Where:

- 1000 is needed to get the output in V since the input should be expressed in mV and the gain is a pure number
- LC_{FS} = load cell full scale, 100 Kg
- LC_{SENS} = load cell sensitivity, 2 mV/V
- LC_{SUP} = load cell supply, 5 V
- FA_{GAIN} = forza amplifier gain, sets by the user between 100, 200, 500 and 1000

Torque estimation and technical details

The load cell detects the force, to estimate the torque generated by the knee, it is possible to multiply the force measured by cell for its lever arm. In Tab. 1 load cell technical details and mechanical dimensions are reported.

	Parameter	**Value**
Load Cell	Range	100 kg
	Recommended Supply	10 V
	Non linearity	± 0.02 % F.S.
	Sensitivity	~ 2 mV/V
	Lever arm	720 mm

Tab. 1. *Load cell Technical details.*