EMG Isokinetics Setup

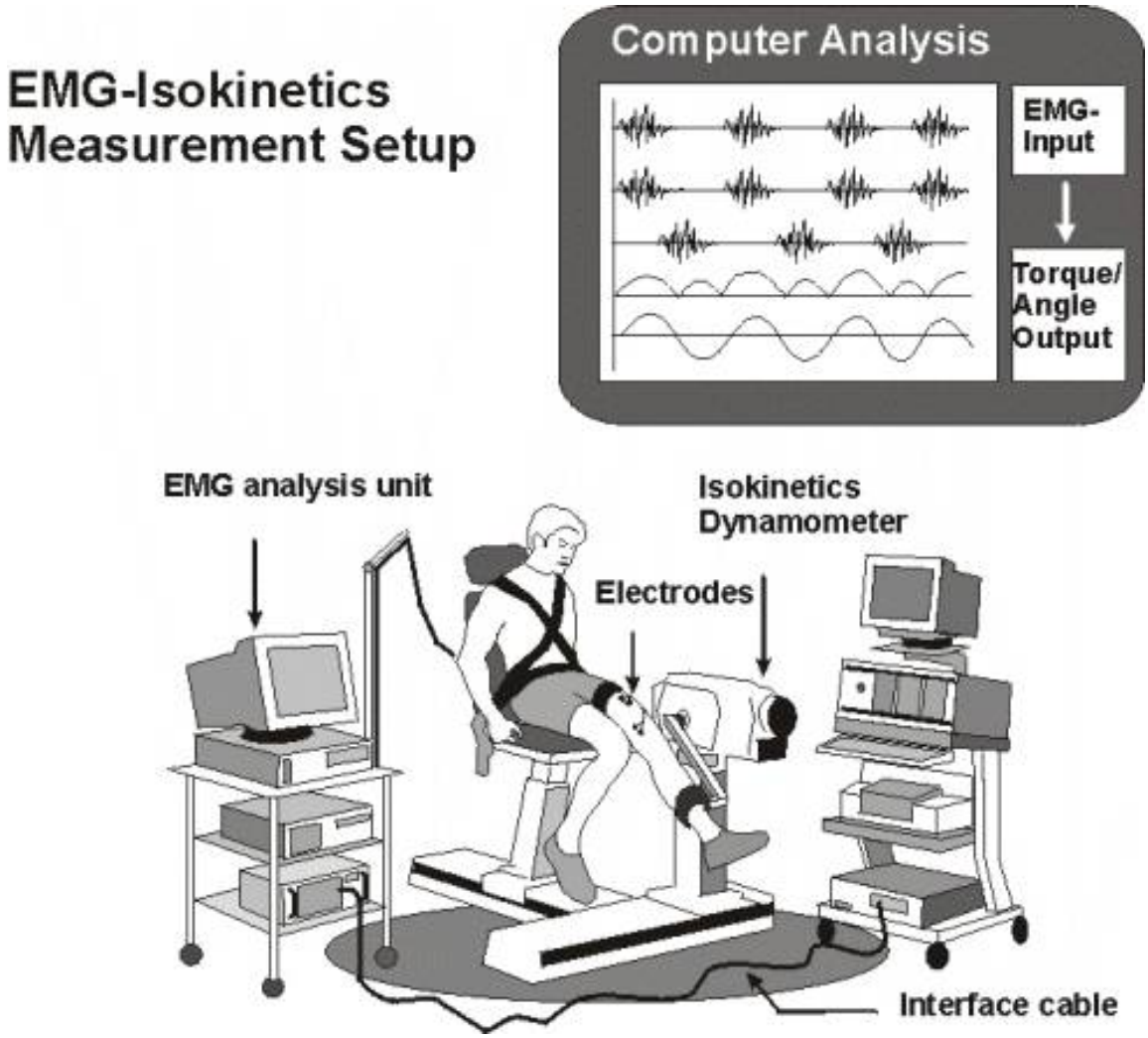
Instruction to install and start an EMG-Isokinetics setup

Introduction

Using EMG as an evaluation tool in sports science, physical therapy, ergonomics and other biomechanical oriented disciplines always used to be a very time consuming and difficult-to-analyze approach. Due to many new possibilities in biomedical engineering technology and computer based data analysis NORAXON has developed a very easy to use and nearly automatic protocol setup, that will end these problems. The concept includes NORAXON's innovative, artifact free amplifier technology and combines it with it’s new software package, "MyoResearch". The EMG-Isokinetics application protocol is based on this comprehensive scientific tool package and enables a widespread use of very convenient to use analysis, which is available as a printed report generated within a few seconds.

NORAXON's EMG-Isokinetics application package can be combined with nearly any isokinetics machine or other device that supports anolog signals of force/torque, angle, direction or velocity.

The EMG-Isokinetic application package includes commonly used standard activities for the main joint-regions. The concept of EMG data analysis used in the application protocols can be adjusted to any other activity, can be upgraded in amount of channels detected, and even the contents and size of reports can be changed to individual needs.



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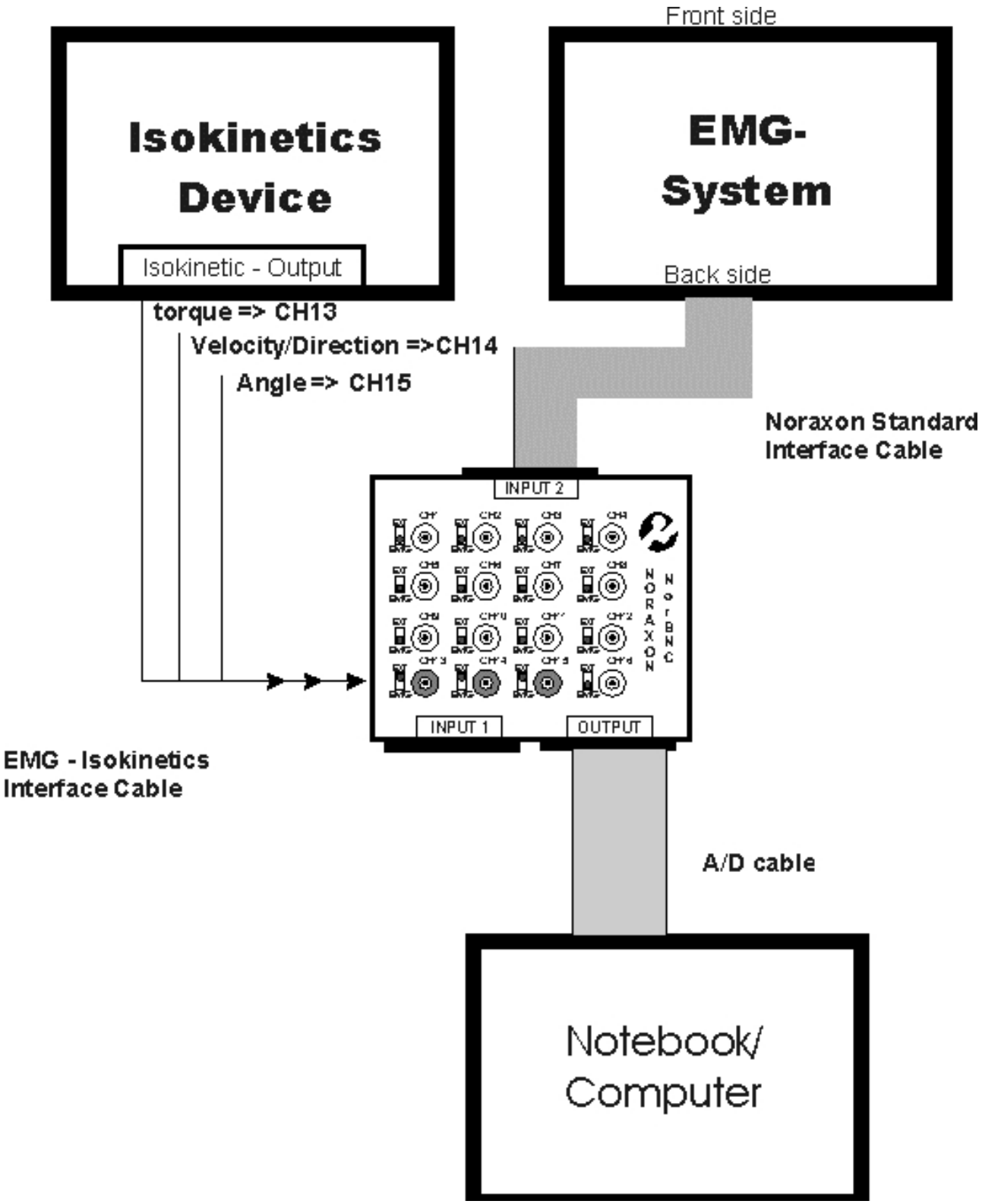
Technical setup

All isokinetics dynamometers, sensor equipped strength training machines or comparable apparatus can be combined to the NORAXON EMG systems. The only requirement is an analog outlet connection, where torque, angle, velocity or direction signals can be picked up in the standard measurement range of plus 5 or 10 Volts. Some commercial equipments must be updated to do so (eg. Cybex 6000, Cybex Norm, Biodex3). Please contact your manufacturer for more details.

The EMG – Isokinetics setup requires two separate computers: one to control the dynamometer, the other one to control the EMG unit.

The NORAXON Isokinetics upgrade kit contains all necessary components to feed these signals to the EMG amplifier, were analog and EMG signals are synchronized, A/D converted and displayed in MyoResearch's Isokinetics applicaton protocols.

To combine the isokinetics device and the Noraxon EMG system (MyoSystem 2000, MyoSystem 1200 / 1400, TeleMyo) a special interface cable and connector box (NorBNC) is needed. The following scheme shows all needed components:



Step 1: Turn off all equipment

Step 2: Connect the EMG – Isokinetics Interface Cable to the analog output connector of the isokinetics device. On the other end connect the BNC connectors to channel 13 (torque), 14 (direction or velocity) and 15 (angle) of the NorBNC box. Flip the local switch left of these three connectors to “EXT”. All other channels should be switched to “EMG”.

Step 3: Connect the Noraxon Standard Interface Cable to the output connector of the EMG system (back side). On the other end connect this cable to the INPUT 2 of the NorBNC box.

Step 4: Connect the A/D Cable to the OUTPUT connector of the NorBNC box and to the A/D board of your EMG (!) computer.

Step 5: Start all devices and PCs, open the software programs to initialize the systems. In MyoResearch, 4 predefined protocols can be found in the protocol group “Isokinetics”. Start any protocol and check if analog signals are visible on trace 13 (torque), 14 (direction / Cybex or velocity/Biodex), 15 (angle).: Manually move the lever arm and check signal changes.

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Calibration of analog signals in MyoResearch

It is possible to calibrate the dynamometer signals in MyoResearch. The procedure is the same for all types of biomechanical signals and will be explained by using the torque signal

Step 1: Prepare the whole system for a measurement, check if the torque channel can be seen in MR (MyoResearch).

Example for a 4 EMG channel isokinetics measurement

Step 2: Unload the torque sensor (eg. move it to the perpendicular position).

Step 3: "Calibrate" (which means offset correction) the torque channel by hitting small local yellow channel calibration button left to the channel trace.

Now the incoming torque current (=zero torque) is moved to the MR zero line.

Step 4: Now start a measurement for 5 seconds and pause it.

Step 5: Move the isokinetics lever arm to the horizontal position and load it with a known (this would check the isokinetics too) or any other weight eg. a 20kg barbell.

Step 6: Multiply the load by the distance to the axis to check the torque, or check in the isokinetics software, which torque value is shown at this position

Step 7: Now restart the MyoResearch measurement for another 5 seconds and finally store/close it.

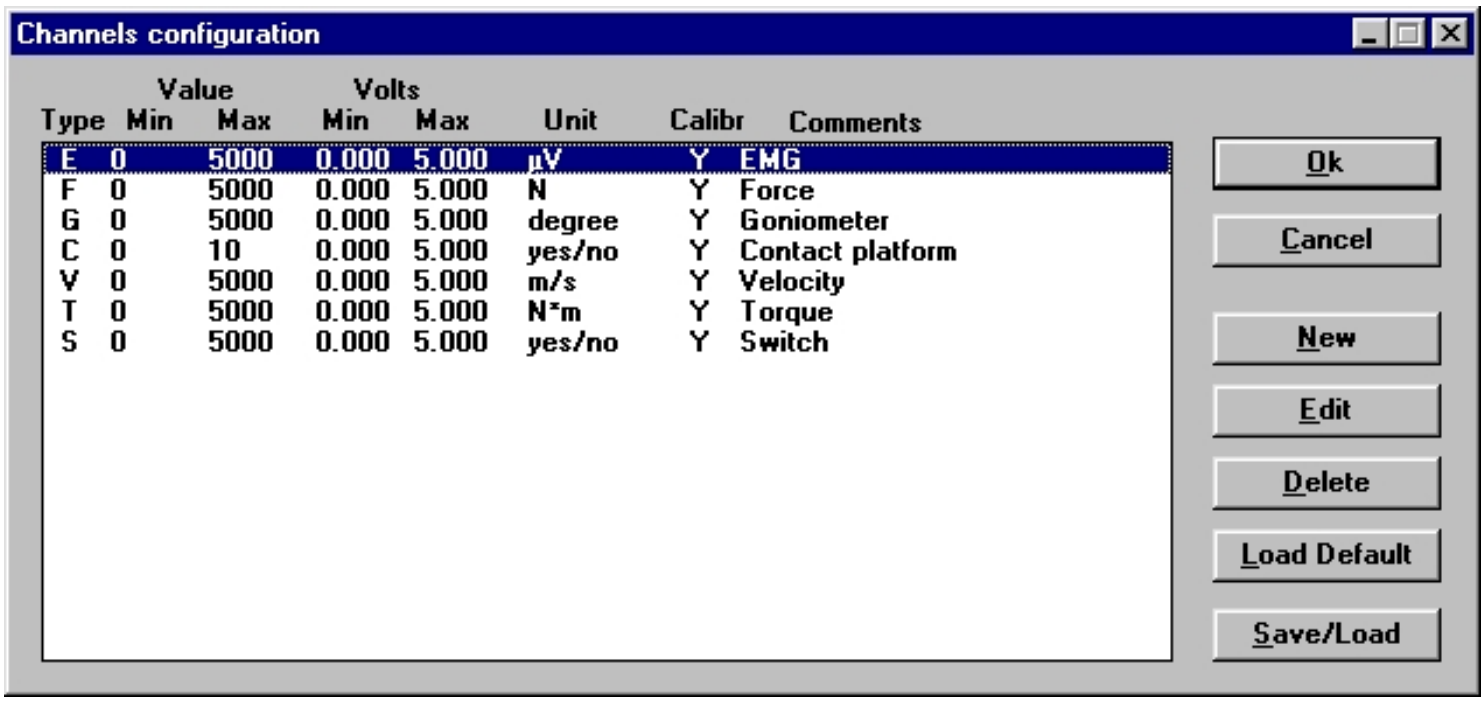
Step 8.: In database now load this calibration measurement to the record viewer by hitting "View".

Step 9: Set two markers in the first part of measurement (before the red line), maybe with a duration of 4000 ms between them. Now click within this interval and zoom it up ("AZoomB").

Step 10: Hit "Statistics" in the top menu and note the mean value of this first zero calibration period. This value should be very near to zero.

Step 11: Now repeat the same procedure for the second half of the measurement (loaded period): two markers, zooming of this period, statistics, mean value. This mean value now must be calibrated to the real torque input (which you know from the known weight or isokinetics Software)

Step 12: Leave your calibration measurement and enter "Setup/channel setup":



Step 13: In the column "Volts" / "Max" you see a default calibration value of 5.000 for the channel type torque "T",

which of course is incorrect.

The correct value can now be calculated by this formula:

Current MaxVolt value x correct physical value / actually measured value

Physical value= coming from the isokinetics Software or true calculation

Actually measured value = the mean of the second period (loaded condition) of your calibration measurement.

The result of this calculation is entered as the new MaxVolt Value for torque.

Step 14: Now repeat the calibration measurement and check if the mean of the

loaded period now compares to the isokinetics value.

Step 15: Repeat this for all types of sensors....

This type of calibration is “relative”. This means that you have to ensure that the MyoResearch analog input channel is always zero-corrected to the zero level of the sensor (=unload the sensor and hit the yellow channel calibration button) before you start a measurement.

Once the channel calibration value is determined, it is not necessary to check it each time, but maybe once per month (because of sensor drift).

Please consider that depending on the joint under investigation the zero angle position may differ. Whenever the joint is zero, hit MyoResearch's channel calibration to define the current (lever arm-) angle position as "zero". This is meant with a "relative calibration".

Important: you can disable analog channel calibration from global calibration (top menus big yellow calibration button) by hitting the smal "x" - button left to the analog channel.

Don't forget that due to different mechanical conditions the isokinetics torque sensor can already be loaded by lever arms, extremities etc...

Whatever comes in, you can decide if you would like it to be corrected to MyoResearch's zero line (= this compares to a gravity correction).

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Troubleshooting

No analog signal changes can be seen in MyoResearch.

Try one of these actions:

1. Check all cable connections and the position of the each channel switch on the NorBNC box.

2. Check with a simple voltmeter if analog voltage directly at the isokinetics output connector is changing due to sensor load

3. Check with a simple battery current (between +/- 9 Volts) if analog signals can be read by MyoResearch

Step 2 and 3 determine if the problem is located at the isokinetics or the the EMG system side.

In case of no signal coming out from the dynamometer please contact your Isokinetics service, in case of no signal coming into MyoResearch continue with this check list:

- Does the EMG really work at all (check the EMG traces)?

- Do the channel numbers on the NorBNC box compare to the channel numbers inside MyoResearch?

- Are the local switches beside NorBNC channel 13 – 15 correctly set to “EXT”?

- Did you properly set the channel calibration value (default MaxVolt value for testing= 5000)?

In case no further reason can be identified please contact our support.

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