Muovi probe

TCP Communication Protocol v2.4

This document describes the protocol used during the direct communication with a single Muovi probe. For communication through the SyncStation, check the related document.

After reset, the Muovi probe search for a TCP socket on port 54321. It has to be opened on the PC used for the data acquisition. In case the Muovi is the access point (turn it on by holding the ON/OFF switch for few seconds), it automatically gets the address when the PC connect to its network.

Once the connection has been established, the user can communicate with Muovi using the protocol described in this document.

Additionally, to the EMG/EEG signals, 6 auxiliary channels are always present in all the detection modes. The 6 auxiliary channels are:

Aux CH	Group	Description
1	IMU Quaternion data	W
2		X
3		Y
4		Z
5	Accessory	Buffer Usage
6		Sample counter

The configuration byte description follows.

CONTROL BYTE:

0	0	0	0	EMG/EEG	MODE1	MODE0	GO/STOP

bit 3   **EMG/EEG:** Working mode

         1 = EMG Mode Fsamp 2000 Hz, high pass filter at 10 Hz [1], 16 bit resolution

         0 = EEG Mode Fsamp 500 Hz, DC coupled, 24 bit resolution

bit 2-1   **MODE<2:0>:** Detection mode

         11 = Test mode. Sends ramps on all 32 channels + 6 accessory

         10 = Impedance check on all 32 channels + 6 accessory

         01 = This option only affects EMG mode and firmware version 3.2.0 or higher. If EEG is set, or previous version of firmware is used, this mode is the same as 00. Monopolar mode with preamp gain is 4. 32 monopolar bioelectrical signals + 6 accessory signals. Resolution is 572.2 nV and range +/-18.75 mV [2].

         00 = Monopolar mode with preamp gain 8. 32 monopolar bioelectrical signals + 6 accessory signals. Resolution is 286.1 nV and range +/-9.375 mV [2].

bit 0   **GO/STOP:** Starts/stops the data transfer on the TCP socket

         1 = Go

         0 = Stop and close the socket

(1) High pass filter implemented by firmware subtracting the exponential moving average, obtained by:

$$Average\_ChX[t] = (1-α) \, Average\_ChX[t-1] + α \, ChX[t]$$

Where α is equal to 1/25 for MODE = 0, 1 or 2. It is equal to 1/2 in case of Impedance check.

For the standard modes, this result in a high pass filter with a cut-off frequency of 10.5 Hz, when sampling the signals at 2000 Hz. More in general the cut-off frequency is Fsamp/190.

(2) Preamp gain of 4 has a double input range and a slightly larger noise w.r.t. preamp gain of 8. It can be used when DC component of EMG signals is higher and generates saturation before the high pass filter resulting in flat signals. The input range before the high pass filter is +/-600mV when the preamp is set to 4 and +/-300mV when the preamp is set to 8.