Communication protocol between EMG Amplifier and PC

LIST OF COMMANDS

- **Turn ON power supply for EMG amplifiers**

  Command: **(CH1:ON)**

  Command: **(CH2:ON)**

  Command: **(CHs:ON)**

  This command turns on isolated power supply for EMG amplifiers on either CHANNEL 1 or CHANNEL 2 or on both. This command can be sent only when acquisition isn't active and EMG amplifiers power supply is OFF. DEVICE will respond with **(OK)** or **(ERR)**.

- **Turn OFF power supply for EMG amplifiers**

  Command: **(CH1:OFF)**

  Command: **(CH2:OFF)**

  Command: **(CHs:OFF)**

  This command turns off isolated power supply for EMG amplifiers on either CHANNEL 1 or CHANNEL 2 or on both. This command can be sent only when acquisition isn't active and EMG amplifiers power supply is ON.

  DEVICE will respond with **(OK)** or **(ERR)**.

- **Set sampling frequency**

  Command: **(F:250)**

  Command: **(F:500)**

  This command sets sampling frequency to desired value. This command can be sent only when acquisition isn't active and EMG amplifiers power supply is ON.

  DEVICE will respond with **(OK)** or **(ERR)**.

- **Turn TEST mode ON**

  Command: **(TEST)**

  This commands turns on internal square-wave test generators on all channels. This command can be sent only when acquisition isn't active and EMG amplifiers power supply is ON. When turned ON device will send those test values on all enabled CHANNELS.

  DEVICE will respond with **(OK)** or **(ERR)**.

- **Turn NORMAL mode ON**

  Command: **(NORMAL)**

This command is used for normal electrode mode. This command can be sent only when acquisition isn't active and EMG amplifiers power supply is ON. When turned ON device will send values measured on electrodes on all enabled CHANNELS.
DEVICE will respond with **(OK)** or **(ERR)**.

- **Start EMG acquisition**
  Command: **(START)**
  This command will start EMG acquisition. DEVICE will respond with **(OK)** or **(ERR)**. After **(OK)** response, DEVICE will continuously send EMG samples in the following format (each CHANNEL is represented using 3 bytes in complement 2 - see conversion):

  (CH1 CH2 COUNTER BATTERY CHKSUM)

(	Beginning of the message.
CH1	Channel 1 data - 3 bytes in 2's complement (see conversion)
CH2	Channel 2 data - 3 bytes in 2's complement (see conversion)
Counter	Sample number – goes from 0 to 255.
Battery	Battery level [%]
CS	Checksum - XOR of all bytes in the message except '(' and ')'
)	End of the message

  One message represents one sample. Size of one message is 11 bytes (1 byte BEGINNING, 3 bytes CHANNEL 1, 3 bytes CHANNEL 2, 1 byte COUNTER, 1 byte BATTERY, 1 byte CHECKSUM, 1 byte END).

- **Stop EMG acquisition**
  Command: **(STOP)**
  This command will stop EMG acquisition. This command can be sent only when acquisition is active and EMG power supply is ON.
  DEVICE will respond with **(OK)** or **(ERR)**.

Pseudo code for conversion of the EMG A/D units into µV

```
Reference_V = 4.5                    #A/D converter reference voltage
Amp_Gain = 24                        #gain of the amplifiers

C1_AD = (C1_first_byte << 16) | (C1_second_byte << 8) | (C1_third_byte)
#merge all bytes of CHANNEL 1 in one variable

if C1_AD >= 8388608
#most important bit defines sign (0 – positive; 1 - negative)
C1_AD = C1_AD – 16777216;

Scale_Factor_uV = 1000000 * ((Reference_V / (8388608 - 1)) / Amp_Gain)
#scale factor for converting from A/D units to voltage

Channel_1 = C1_AD * Scale_Factor_uV;
```