

Sessantaquattro+

TCP Communication Protocol v2.1

Implemented in firmware v1.26 or higher

After reset, sessantaquattro+ search for a TCP socket. It has to be opened on the PC used for the data acquisition. In case the sessantaquattro+ is the access point, it automatically gets the address when the PC connect to its network.

If an external access point is used, the IP address has to be provided through its internal web page in the field "Server IP address". This value is automatically updated if Firefox or Chrome is used to open the sessantaquattro+ internal webpage. If another browser is used the field have to be manually filled with the proper IP address (i.e. the IP address of the PC used for the acquisition).

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

It is possible to read the sessantaquattro+ current settings or apply new settings.

NOTE: the sessantaquattro+ will discard new settings if the acquisition on the internal SD card is running and the new settings are different from the currently used.

The configuration bytes are the following:

- CONTROL BYTE 0
- CONTROL BYTE 1
- FILE SIZE 0
- FILE SIZE 1
- FILENAME PREFIX 0
- FILENAME PREFIX 1
- FILENAME PREFIX 2
- FILENAME PREFIX 3
- FILENAME PREFIX 4
- TIMEDATE 0
- TIMEDATE 1
- TIMEDATE 2
- TIMEDATE 3

The detailed description of each byte is in the following pages. Not all the bytes are necessary, but at least the first two have to be sent in order to change the sessantaquattro+ settings.

CONTROL BYTE 0 with GETSET = 0:

GETSET	FSAMP1	FSAMP0	NCH1	NCH0	MODE2	MODE1	MODE0
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bit 7 **GETSET = 0** Describe the type of action

1 = GET settings. The description in this particular case is described at the end of this document.

0 = SET command. All the other bits and bytes are used to set new values to the sessantaquattro+ settings.

bit 6-5 **FSAMP<1:0>**: Sampling frequency

11 = 4000 Hz (applicable only to a reduced number of channels)

10 = 2000 Hz

01 = 1000 Hz

00 = 500 Hz

bit 4-3 **NCH<1:0>**: Transferred channels (refer to the user manual for additional details):

11 = 64 bioelec. + 2 AUX + 2 accessory (if MODE=001: 32 bio + 2 AUX + 2 acc)

10 = 32 bioelec. + 2 AUX + 2 accessory (if MODE=001: 16 bio + 2 AUX + 2 acc)

01 = 16 bioelec. + 2 AUX + 2 accessory (if MODE=001: 8 bio + 2 AUX + 2 acc)

00 = 8 bioelec. + 2 AUX + 2 accessory (if MODE=001: 4 bio + 2 AUX + 2 acc)

bit 2-0 **MODE<2:0>**: Working mode

111 = Test mode. Sends ramps on all channels

110 = Impedance check.

101 = Impedance check advanced.

100 = Bipolar using AD4x8SP adapter. External preamps have a gain of 5.

011 = Accelerometers. Only 8 channels (plus 2 aux and 2 accessory) are acquired and transferred (even if NCH has a different value) with increased sampling frequency. FSAMP in this mode has the values 2000, 4000, 8000 and 16000 Hz.

010 = Differential. All the channels are the difference between consecutive inputs over groups of 32 channels. Channels 32 and 64 are monopolar. **NOTE:** the configuration 64 CH, 16 bits resolution, HPF on and 2000 Hz, will retrieve all monopolar signals even if set on Differential.

001 = Bipolar using AD8x1SP adapter (differences between Ch3-1 Ch4-2 Ch7-5...)

000 = Monopolar. All the channels are acquired with respect to the reference.

CONTROL BYTE 1:

HRES	HPF	GAIN1	GAIN0	TRIG1	TRIG0	REC	GO/STOP
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- bit 7 **HRES:** High resolution
 1 = samples on 24 bits
 0 = samples on 16 bits
- bit 6 **HPF:** High pass filter
 1 = High pass filter implemented by the microcontroller subtracting the exponential moving average, obtained by:

$$\text{Average_ChX}[t] = (1-\alpha) \text{Average_ChX}[t-1] + \alpha \text{ChX}[t]$$
 Where α is equal to $1/2^5$ 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 $F_{\text{samp}}/190$.
 0 = DC signals (to be used with the high resolution)
- bit 5-4 **GAIN<1:0>:** Preamp gain, there are differences depending on the resolution:
 11 = preamp gain is 8. If HRES=1 the resolution is 71.5 nV and range +/- 300mV. If HRES=0 the resolution is 286.1 nV and range +/-9.375 mV.
 10 = preamp gain is 6. If HRES=1 the resolution is 95.4 nV and range +/-400mV. If HRES=0 the resolution is 381.5 nV and range +/-12.5 mV.
 01 = preamp gain is 4. If HRES=1 the resolution is 143 nV and range +/- 600mV. If HRES=0 the resolution is 572.2 nV and range +/-18.75 mV
 00 = if HRES=1, the preamp gain is 2, the resolution is 286.1 nV and range +/- 1200mV. If HRES=0 the preamp gain is 8, resolution is 286.1 nV and range +/- 9.375 mV.
- bit 3-2 **TRIG<1:0>:** event trigger to start data transfer or acquisition on SD card
 11 = SD card acquisition starts/stops with the hardware button or with the REC bit
 10 = the data transfer is triggered by the external signal (from the adapter)
 01 = the data transfer is triggered by the internal signal (phototransistor)
 00 = The data transfer is controlled from GO/STOP bit, REC has no effect
- bit 1 **REC:** Starts/stops the acquisition on the MicroSD
 1 = Rec. Works only if TRIG<1:0> = 11
 0 = Stop. Works only if TRIG<1:0> = 11
- bit 0 **GO/STOP:** Starts/stops the data transfer on the TCP socket
 1 = Go
 0 = Stop and close the socket

FILE SIZE 0:

Less significant byte indicating the acquisition on the MicroSD card maximum duration in seconds.

FILE SIZE 1:

More significant byte indicating the acquisition on the MicroSD card maximum duration in seconds.

FILENAME PREFIX 0..4:

Five digits used as prefix for the filenames on the MicroSD card. The following 3 digits will be an incremental number.

TIMEDATE 0..3:

YEAR6	YEAR5	YEAR4	YEAR3	YEAR2	YEAR1	YEAR0	MONTH3
MONTH2	MONTH1	MONTH0	DAY4	DAY3	DAY2	DAY1	DAY0
HOURL4	HOURL3	HOURL2	HOURL1	HOURL0	MIN5	MIN4	MIN3
MIN2	MIN1	MIN0	SEC4	SEC3	SEC2	SEC1	SEC0

Considering the 4 bytes as a single 32 bits variable:

- bit 31-25 **YEAR<6:0>**: Year starting from 1980. Thus, for example, 2017 will be decoded as 37 on these 7 bits.
- bit 24-21 **MONTH<3:0>**: Month, where 0 = January, 1 = February...
- bit 20-16 **DAY<4:0>**: Day decoded starting from 0 (i.e. subtracting 1 to the day number)
- bit 15-11 **HOURL<4:0>**: Hour of the day from 0 to 23
- bit 10-5 **MIN<5:0>**: Minutes from 0 to 59
- bit 4-0 **SEC<5:0>**: Seconds divided by two. The resolution has been reduced to fit in the 32 bits.

CONTROL BYTES 0 and 1 with GETSET = 1:

GETSET	0	0	0	0	0	0	0
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0	0	0	0	0	INFO2	INFO1	INFO0
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- bit 15 **GETSET = 0** Describe the type of action
 1 = GET settings. The INFO bits determine the type of information provided.
 0 = SET command. Described above.
- bit 14-3 **Not used**
- bit 2-0 **INFO<2:0>:** Information requested. Depending on the different code, the
 sessantaquattro+ replies with different information:
 111 = to be defined
 110 = to be defined
 101 = to be defined
 100 = to be defined
 011 = to be defined
 010 = Reply with a byte indicating the battery level as a percentage
 001 = reply with 2 bytes indicating the first and second digit of the firmware
 version
 000 = reply with a sequence of 13 bytes indicating the actual settings.