MAVOSPEC
Communication Protocol

The communication protocol between MAVOSPEC and GL SpectroSoft is based on Extensible Markup Language (XML). The MAVOSPEC listens for incoming connections on TCP port 13000. Only one TCP connection at the time is possible. When MAVOSPEC is connected to the PC via USB, an additional tool must be used to provide port forwarding. The tool is installed on the disk together with SpectroSoft.

Following command creates TCP server port 13000 on PC ready for accepting connection to MAVOSPEC.

"C:\GL Optic\GL_Spectrosoft\adb\adb" forward tcp:13000 tcp:13000

Brief information about messages exchanged between the MAVOSPEC and PC is presented below.

Tag: **request**	Direction: PC → MAVOSPEC

Request an action in MAVOSPEC. Possible actions are specyfied as atribute name

Attribure name:

"measure" - make measurement with current device configuraton
"getconfig" - get device configuration (see "config" message).
"welcome" - get welcome message
"background" - start dark current calibration process. TODO: needs to be completed
beep="on" - do not beep on measurement. Not implemented in MAVOSPEC

Example:

<request name="getconfig" />
<request name="measure" beep="on" />

Tag: **config**	Direction: MAVOSPEC → PC, PC → MAVOSPEC

Used for reading and changing the device configuration.

MAVOSPEC sends the configuration message to the PC each time when something changes in the device configuration (for example an accessory change occurs or a new TCP connection to the device is opened). The configuration can also be requested by sending the appropriate request message.

The config message is also used to change the configuration of the MAVOSPEC. When the client software wants to change something in the MAVOSPEC configuration, it sends a modified config message to the MAVOSPEC.

The main parameters of the measurement are placed in tags "stage". The value type defines the allowed parameter type. The tag stage named "average" contains the main values which are used to configure the measurement.

Attribute name:

"integrationTime"	- sets integration time to be used by MAVOSPEC during measurement. The min and max attributes contain the defined range of allowed values for the integration time and cannot be changed.
"repeatCount"	- sets the number of measurement repetitions. The measurement result send to the PC is the average over the given number of measurements.
"autoIntegration"	- turns on/off automatic mode - the effective integration time in this mode will be calculated based on available amount of light. The calculated integration time is stored in integrationTime.
"maximumIntegrationTime"	- defines maximum value of integration time which could be used in autoIntegration mode.
"flickerFrequency"	- allows to set frequency [Hz] of measured light flicker. This frequency is used in automatic mode to determine the integration time which is a multiple of the flicked period.

Stage Interpolation is not important.

Section "global" contains information about mounted accessory code (value name="measuringHeads") and allows to start dark current calibration (value name="Calibration"). Changing text "Select calibration.." to "Dark Current" will execute dark current calibration on the device.

Example of received config message:

```
<config version="0.0.1">
<stage type="AverageStage" name="average" caption="Measurement">
  <value type="uint" name="integrationTime" caption="Integration time" min="5" max="10000"
    unit="[ms]">10</value>
  <value type="int" name="repeatCount" caption="Repeat" min="1" max="250" unit="">1</value>
  <value type="bool" name="autoIntegration" caption="Auto">true</value>
  <value type="uint" name="maximumIntegrationTime" caption="Maximum integration time" min="5"
    max="10000" unit="[ms]">10000</value>
  <value type="double" name="flickerFrequency" caption="Flicker frequency">50.000000</value>
</stage>
<stage type="InterpolationStage" name="interpolate" caption="Range">
  <value type="uint" name="lowerWaveLength" caption="Lowest wavelength" min="340" max="750"
    unit="[nm]">340</value>
  <value type="uint" name="upperWaveLength" caption="Highest wavelength" min="340" max="750"
    unit="[nm]">750</value>
</stage>
<global>
  <value type="QString" name="measuringHeads" caption="Measuring head">
    <option caption="">010.cfg</option>
  010.cfg</value>
  <value type="QString" name="Calibration" caption="Calibration">
    <option caption="Select calibration..">Select calibration..</option>
    <option caption="Dark Current">Dark Current</option>
  Select calibration..</value>
</global>
</config>
```

Example of message sent to MAVOSPEC to disable automatic mode, set integration time to 5000 and make average of 10 measurements:

```
<config version="0.0.1">
<stage type="AverageStage" name="average" caption="Measurement">
  <value type="uint" name="integrationTime" caption="Integration time" min="5" max="10000"
    unit="[ms]">5000</value>
  <value type="int" name="repeatCount" caption="Repeat" min="1" max="250" unit="">10</value>
  <value type="bool" name="autoIntegration" caption="Auto">false</value>
  <value type="uint" name="maximumIntegrationTime" caption="Maximum integration time" min="5"
    max="10000" unit="[ms]">10000</value>
   <value type="double" name="flickerFrequency" caption="Flicker frequency">50.000000</value>
  </stage>
  <stage type="InterpolationStage" name="interpolate" caption="Range">
    <value type="uint" name="lowerWaveLength" caption="Lowest wavelength" min="340" max="750"
      unit="[nm]">340</value>
    <value type="uint" name="upperWaveLength" caption="Highest wavelength" min="340" max="750"
     unit="[nm]">750</value>
  </stage>
  <global>
    <value type="QString" name="measuringHeads" caption="Measuring head">
    <option caption="">010.cfg</option>
    010.cfg</value>
    <value type="QString" name="Calibration" caption="Calibration">
    <option caption="Select calibration..">Select calibration..</option>
    <option caption="Dark Current">Dark Current</option>
    Select calibration..</value>
  </global>
</config>
```

Tag: **nop**	Direction: MAVOSPEC → PC

Sent by MAVOSPEC to confirm that link is active.

Example:

```
<nop />
```

Tag: **hello**	Direction: MAVOSPEC → PC

First message sent by MAVOSPEC after opening connection

Example:

```
<hello server_name="MAVOSPEC" version="1.0.17" /><?xml version="1.0" encoding="UTF-8"?>
```

Tag: **progress**	Direction: MAVOSPEC → PC

This message informs PC about measurement progress. The value contains % of progress.

Example:

<progress value="36"/>

Tag: **notification**	Direction: MAVOSPEC → PC

Notification about changes in state warnings or errors in MAVOSPEC. The type describes the level of importance.

Example:

<notification type="info">Accessory : 010</notification>

Tag: **measurement**	Direction: MAVOSPEC → PC

In section status measurement contains informations about the process of making measurement and calculating results.

Section "data" contains data from spectrometer.
Tag "range" describes range of wavelenghts which are considered as usable for mounted accessory.
Tag interpolation describes details of processing.
Tag results contains parameters calculated by MAVOSPEC.

Example:

<?xml version="1.0" encoding="UTF-8"?><measurement version="0.0.1">
<status>
<parameter caption="GL MAVOSPEC" name="SPX version">0.0.1</parameter>
<parameter caption="date" name="date">2000-01-01T01:16:17</parameter>
<parameter caption="device name" name="device name">GL MAVOSPEC</parameter>
<parameter caption="device sensor temperature" name="device sensor temperature">31.3125</parameter>
<parameter caption="device serial number" name="device serial number">GLX10t 00000000</parameter>
<parameter caption="integration time" name="integration time">439443</parameter>
<parameter caption="measuring head" name="measuring head">null</parameter>
<parameter caption="repeat count" name="repeat count">1</parameter>
<parameter caption="signalLevel" name="signalLevel">19.648</parameter>
<parameter caption="measuring head" name="measuring head">010</parameter>
<parameter caption="dark current status" name="dark current status">missing dark current calibration</parameter>
<parameter caption="maximum measurement" name="maximum measurement">12845.000</parameter>
<parameter caption="coefficient_y" name="coefficient_y">3.415</parameter>

```
  <parameter caption="internalSignalLevel"
    name="internalSignalLevel">19.647692307692306</parameter>
  <parameter caption="minimum wavelength" name="minimum wavelength">716.887</parameter>
  <parameter caption="sensor number" name="sensor number">00000000</parameter>
  <parameter caption="temperature" name="temperature">31.3125</parameter>
  <parameter caption="signalLevel" name="signalLevel">19.648</parameter>
  <parameter caption="minimum measurement" name="minimum
    measurement">10615.000</parameter>
  <parameter caption="deltaTBase" name="deltaTBase">7.0</parameter>
  <parameter caption="maximum measurement linearized" name="maximum measurement
    linearized">12771</parameter>
  <parameter caption="correction characteristic file" name="correction characteristic
    file">010</parameter>
  <parameter caption="maximum wavelength" name="maximum wavelength">440.849</parameter>
  <parameter caption="repeat count" name="repeat count">1</parameter>
  <parameter caption="integration time" name="integration time">439443</parameter>
  <parameter caption="coefficient_y_unit1" name="coefficient_y_unit1">mW/m^2/nm</parameter>
  <parameter caption="coefficient_y_unit2" name="coefficient_y_unit2">lx</parameter>
</status>
<data>
  <range minimum="340" maximum="750"/>
  <coefficient_y value="3.415" unit1="mW/m^2/nm" unit2="lx"/>
  <interpolation type="NN"/>
  <row wavelength="328.91513514677234" value="47.981112102767476"/>
  <row wavelength="330.7993506731713" value="39.17874256838403"/>
  <row wavelength="332.6829222800259" value="46.720907267851075"/>
  <row wavelength="334.56585612467927" value="39.50425632666881"/>
  <row wavelength="336.44815792545506" value="46.400439439783085"/>
  <row wavelength="338.3298329661238" value="36.804116078677055"/>
   .....
  <row wavelength="759.4338925417969" value="53.12180916576016"/>
  <row wavelength="760.9301014727037" value="65.67816078974904"/>
  <row wavelength="762.4249982730362" value="56.47511951822898"/>
  <row wavelength="763.9186176844042" value="69.93841240322143"/>
  <row wavelength="765.4109951214967" value="60.18972291673988"/>
  <row wavelength="766.902166676547" value="74.60304039954613"/>
  <row wavelength="768.3921691237987" value="64.3233201397321"/>
</data>
<results>
  <parameter name="x2" caption="x2">0.325366</parameter>
  <parameter name="y2" caption="y2">0.296206</parameter>
  <parameter name="Y2" caption="Y2">654.579956</parameter>
  <parameter name="u2" caption="v2">0.220447</parameter>
  <parameter name="v2" caption="v2">0.301036</parameter>
  <parameter name="u2'" caption="v2'">0.220447</parameter>
  <parameter name="v2'" caption="v2'">0.220447</parameter>
  <parameter name="CCT" caption="CCT">5945.000000</parameter>
  <parameter name="ColPeak" caption="Color peak">766.902167</parameter>
  <parameter name="Ra" caption="Ra">79.955810</parameter>
  <parameter name="R01" caption="R01">74.911423</parameter>
  <parameter name="R02" caption="R02">87.094476</parameter>
  <parameter name="R03" caption="R03">92.738168</parameter>
  <parameter name="R04" caption="R04">73.246737</parameter>
  <parameter name="R05" caption="R05">76.337591</parameter>
  <parameter name="R06" caption="R06">87.295559</parameter>
```

```
  <parameter name="R07" caption="R07">86.298543</parameter>
  <parameter name="R08" caption="R08">61.723985</parameter>
  <parameter name="R09" caption="R09">-0.831876</parameter>
  <parameter name="R10" caption="R10">75.985319</parameter>
  <parameter name="R11" caption="R11">73.022323</parameter>
  <parameter name="R12" caption="R12">71.083260</parameter>
  <parameter name="R13" caption="R13">77.265477</parameter>
  <parameter name="R14" caption="R14">95.124887</parameter>
</results>
</measurement>
```

Printed in Germany – Subject to change without notice

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