# Serial Port Commands

## A. Formulas:

The calculation formula for converting spectrometer wavelength into step number position is:

$$\alpha = \text{arctg}\left(\frac{W}{\sqrt{C^2 - W^2}}\right)$$

If a<0, then:

$$P = T + \left(\frac{0.5 \times \alpha \times T}{\pi}\right) + Z$$

If a≥0, then:

$$P = \frac{0.5 \times \alpha \times T}{\pi} + Z$$

The calculation formula for converting the step position into the wavelength of the spectrometer is:

$$\alpha = \frac{2\pi(P - Z)}{T}$$

If a<0, then:

$$\alpha = \frac{2\pi(T + P - Z)}{T}$$

$$W = C \times \sin(\alpha)$$

Parameters meaning:

a: Angle of grating platform (intermediate variable)

W: The wavelength to be converted.

C: Grating correction factor. (This value is readable. Note: Each grating corresponds to 1 correction factor and 1 zero location.)

T: Total number of steps (This value is readable and unique.)

Z: Zero position (This value is readable. Each grating corresponds to one.)

P: The number of steps corresponding to the wavelength.

Note: P, T, and Z are steps, so their values must be positive integers.

## B. Commands

**1. Connection Command**

Command: "?"&CHR$(13)

Description: The spectrometer will check this command after finishing initializing. The spectrometer won't run other commands until receiving this command. The spectrometer will return data1&CHR$(13)&data2&CHR$(13)&"OK"&CHR$(13) after it receives this command. Before receiving this command, the spectrometer will return "E01"&CHR$(13) for any other commands.

Parameters:

data1 is the model number of the spectrometer.

data2 is the output port type. 0 is single output port. 1 is motorized dual output ports. 2 is manual dual output ports.

**2. Parameters Setting Group**

Command: "S"&CHR$(13)

Description: The spectrometer will return "OK"&CHR$(13) after receiving this command and then the following commands of parameters setting can be used.

(1) Set the working range of filter

Command:

"p"&data1&data2&CHR$(13),lim_1&CHR$(13),n_1&CHR$(13),lim_2&CHR$(13),n_2 &CHR$(13)........lim_x&CHR$(13),n_x&CHR$(13)

Parameters:

data1 is the grating number.

data2 is the number of filters. The value is from 1 to 8.

lim_1 to lim_x is the corresponding motor steps of the initial wavelength for NO. 1 to x filter. lim_1 < lim_2<.......< lim_x

n_1 to n_x is the number of filter selected before reaching the motor steps. The value range is from 1 to the total number of filters.

The spectrometer will return "OK"&CHR$(13) between the data and at the end. The next command or data can be entered after the program receives this return.

Note: The calibration factor and zero drift of each gratin is not same, so the working range of filters must be set separately.

(2) Enable or not enable the function of automatic filter switching

Command: "f"&"0"&CHR$(13) or "f"&"1"&CHR$(13)

Description: f0 means to not enable the filter switching. f1 means to enable the filter switching. If the parameters of filters are not set, it will return "E07"&CHR$(13), otherwise it will return "OK"&CHR$(13).

(3) Enable to automatically switch the wavelength for dual output ports

Command: "A"&number_1&CHR$(13), number_2&CHR$(13), number_3&CHR$(13)

Parameters:

number_1 is the motor steps of the wavelength that the NO.1 grating automatically switches to.

number_2 is the motor steps of the wavelength that the NO.2 grating automatically switches to.

number_3 is the motor steps of the wavelength that the NO.3 grating automatically switches to.

(4) Set the grating group to be used

Command: "E"&data1&data2&CHR$(13)

Description: If the specified grating group is not set, it will return "E07"&CHR$(13). Otherwise it will return "OK"&CHR$(13).

Parameters:

data1 is the grating group number. Its value range is from 0 to 3.

data2 is a redundant parameter. Its value should be 1.

## 3. Parameters Inquiry Group

Command: "Q"&CHR$(13)

Description: The spectrometer will return "OK"&CHR$(13) after receiving this command and then the following commands of parameters inquiry can be used.

(1) Inquiry system parameters

Command: "L"&CHR$(13)

Description: The spectrometer will return

data_L&CHR$(13)&data_C&CHR$(13)&data_T&CHR$(13),data3&CHR$(13)&"OK"&CHR$(13).

Parameters:

data_L is the series number of the spectrometer

data_C is the max grating number that can be used

data_T is the total steps

data3 is the number of current grating group. Its value is usually 0.

(2) Inquiry grating group number

Command: "T"&data1&data2&CHR$(13)

data1 is the number of grating group. Its value is from 0 to 3. Its value is 0 for current instruments.

data2 is the specified grating number. Its value is from 1 to 3.

Description: The spectrometer will return

data_z&CHR$(13)&data_c&CHR$(13)&data_L&CHR$(13)&data_b&CHR$(13)&"OK"&CHR$(13).

Parameters:

dataz_z is the zero order position of the specified grating.

data_L is the engraved lines of grating.

data_b is the blaze wavelength.

(3) Inquiry filters

Command: "F"&CHR$(13)

Description: The spectrometer will return the two results below:

A. Number&"OK"&CHR$(13)

   If the Number is larger than 1, it menas the filters are not set. The spectrometer will then return "OK" CHR$(13) and the inquiry ends.

B. Number&dataNumber&CHR$(13),data_p&CHR$(13),data_f&CHR$(13),data_1&CHR$(13),data_2&CHR$(13)……data_x&CHR$(13),"OK"&CHR$(13)

   If the Number is equal to 0, it means the filters function is turn off. If the Number is equal to 1, it means the filters function is using. The spectrometer will then return dataNumber&CHR$(13),data_p&CHR$(13),data_f&CHR$(13),data_1&CHR$(13),data_2&CHR$(13)……data_x&CHR$(13),"OK"&CHR$(13).

   dataNumber is the total amount of filters.

   data_p is the positioning base.

   data_f is the total steps of the filters.

   data_1 to data_x is the wavelength for each filiter.

(4) Inquiry filter wavelength

Command: "p"&data1&data2&CHR$(13)

data1 is the grating number. Its value is 1, 2 or 3.

data2 is the number of inquiries. Its value is from 1 to 8. It's better to use 8 and it will return 8 initial wavelengths and numbers.

Description:

The spectrometer will return

data1&CHR$(13),lim_1&CHR$(13),n_1&CHR$(13),lim_2&CHR$(13),n2&CHR$(13)......lim_c&CHR$(13),n_c&CHR$(13),"OK"&CHR$(13).

data1 is the number of filters to be used.

lim_x is the motor steps for the initial wavelength of NO.x (logic number) filter.

n_x is the physical number of the filter for the initial wavelength. Its value is from 1 to the total number of filters.

lim1<lim2<......<lim_x.

(5) Inquiry grating switching position

Command: "P"&CHR$(13)

Description: This command is used to inquiry the position after the grating is switched. The spectrometer will return

OpenMode&CHR$(13)&PosG1&CHR$(13)&PosG2&CHR$(13)&PosG3&CHR$(13)&PosOpen &CHR$(13)&"OK"&CHR$(13).

Parameters:

OpenMode is the positioning mode. If its value is 1, the spectrometer will move to the specified position after power is on. If its value is 0, the spectrometer will move to the last position before the power is off last time.

PosG1, PosG2, PosG3 separately means the motor steps for the positioning wavelength of switching to NO.1, NO.2, NO.3 grating.

PosOpen is the motor steps for the positioning wavelength after the spectrometer is power on.

(6) Inquiry switching wavelength of output ports

Command: "A"&CHR$(13)

Description: The spectrometer will return

number_1&CHR$(13),number_2&CHR$(13),number_3 &CHR$(13),"OK"&CHR$(13).

Parameters:

number_1, number_2, number_3 is separately the motor steps for the output port switching wavelength of NO.1, NO.2, NO.3 grating.

(7) Inquiry end

Command: "E"&CHR$(13)

Description: The spectrometer will return "OK"&CHR$(13). It will end the inquiry process.

4. **Running Commands Group**

(1) Rest the spectrometer

Command: "H"&CHR$(13)

Description: The spectrometer will be reset and return "OK"&CHR$(13).

(2) Inquiry the scanning speed

Command: "v"&CHR$(13)

Description: The spectrometer will return speed&CHR$(13)&"OK"&CHR$(13).

Parameters: speed is the current speed value.

(3) Inquiry the current position

Command: "b"&CHR$(13)

Description: The spectrometer will return "b"&Position&CHR$(13)&"OK"&CHR$(13).

Parameters: Position is the motor steps of current wavelength.

(4) Inquiry the current grating number

Command: "g"&CHR$(13)

Description: The spectrometer will return Number&CHR$(13)&"OK"&CHR$(13).

Parameters: Number is the current grating number. Its value is 1, 2 or 3.

(5) Move the grating to change wavelength

Command: "B"&data1&CHR$(13)

Description: The spectrometer will move the grating to change wavelength after receiving this command. During this process, it will continuedly return non-zero byte increment value. It means the displacement of grating. When it returns 0, it means the

end of run. When the position reaches data1, it will return "OK"&CHR$(13).

During this process, you may send a blank instruction (CHR$(32)) to force the spectrometer stopping. The return of end flag is also 0, and then it will return "OK"&CHR$(13).

(6) Switch the gratings

Command: "G"&n&CHR$(13)

Description: The spectrometer will switch the gratings after receiving this command. During this process, it will continuedly return non-zero byte increment value. It means the displacement of grating. When it returns 0, it means the end of run. When the position reaches data1, it will return "OK"&CHR$(13).

During this process, you may send a blank instruction to force the spectrometer stopping. The return of end flag is also 0, and then it will return "OK"&CHR$(13).

Parameters: n is the grating number. Its value is 1, 2 or 3.

(7) Set the speed

Command: "V"&n&CHR$(13)

Description: n is speed value, its value is from 0 to 255. The spectrometer will return "OK"&CHR$(13).

(8) Set the initial wavelength

Command:

"l"&OpenMode&CHR$(13),Pos1&CHR$(13),Pos2&CHR$(13),Pos3&CHR$(13),PosOpen&CHR$(13)

Description: l is the small L. The spectrometer will return "OK"&CHR$(13).

Parameters:

OpenMode is the positioning mode. If its value is 1, the spectrometer will move to the specified position after power is on. If its value is 0, the spectrometer will move to the last position before the power is off last time.

PosG1, PosG2, PosG3 separately means the motor steps for the positioning wavelength of switching to NO.1, NO.2, NO.3 grating.

PosOpen is the motor steps for the positioning wavelength after the spectrometer is power on.

(9) Stop running

Command: "*"&CHR$(13)

Description: Please don't use this command in the loopy moving. Otherwise it will cause errors.

5. **Commands for motorized dual output ports**

(1) Set the status of dual output ports

Command: "D"&data&$CHR$(13)

Parameters: data is 0 means not to enabled the motorized dual output ports. data is 1

means to enabled the motorized dual output ports.

(2) Inquiry the status of dual output ports

Command: "d"&CHR$(13)

Description: The spectrometer will return data&CHR$(13).

Parameters: data is 0 means the motorized dual output ports are not active. data is 1 means to the motorized dual output ports are active. If data is other numbers, it means the motorized dual output ports are not available.

(3) Inquiry the current output

Command: "t"&CHR$(13)

Description: The spectrometer will return data&CHR$(13)&"OK"&CHR$(13).

Parameters: data is the position of the current output. 0 is the vertical output port, 1 is the parallel output port.

(4) Switch the output ports

Command: "w"&data&CHR$(13)

Description: The spectrometer will switch to the specified output port. It will return "OK"&CHR$(13).

Parameters: data is 0 means to switch to NO.0 output port (vertical output port). data is 1 means to switch to NO.1 output port (parallel output port).

(5) Switch the output ports automatically

Command: "C"&data&CHR$(13)

Description: data is 0 means not to switch the output ports automatically. data is 1 means to switch the output ports automatically.

(6) Inquiry the switching status

Command: "c"&CHR$(13)

Description: The spectrometer will return data&CHR$(13).

Parameters: data is 0 means not to switch the output ports automatically. data is 1 means to switch the output ports automatically.

6. **Error Information:**

E01&CHR$(13): The spectrometer doesn't connect with the program. Please use command ?&CHR$(13) to connect with spectrometer.

E02&CHR$(13): Communication errors. It's caused by illegal commands or time out.

E03&CHR$(13): EROM failure or instrument has not been set parameters. In this state, the spectrometer can only receive parameter setting commands.

E04&CHR$(13): Parameters positioning error.

E05&CHR$(13): The input value for total filters is more than 8. No grating group was detected.

E06&CHR$(13): The parameters for filter wheel have been set, but there's no filter

wheel or the filter wheel has fault.

E07&CHR$(13): Selected the parameters group that are not set.

E08&CHR$(13): The data collector has fault.