#### **NIR** spectrometer

With iDus InGaAs CCD

## Basic Components of NIR Spectrometer

- Andor InGaAs iDus CCD
- Newport plane ruled reflectance grating (gold coated). \*1
- PAT-001 rotational stepper motor. \*2



#### Specifications

# Andor iDus InGaAs CCD

#### **Key Specifications**

Model Number	DU491A 2.2μm	Quantum Efficiency Curve
Sensor option	1024 pixels, 25µm pitch	80
Wavelength range	800nm-2.2nm	70
Minimum exposure time	1.4µs	60 🕄 50 🖑 50
Minimum temperature air cooled	-70°C	40 30
Minimum temperature Coolant chiller @16°C	-85°C	20
Minimum temperature Coolant chiller @10°C	-90°C	0 1 1.2 1.4 1.6 1.8 2 2.2 2.4 Wavelength (um)
		that of ongen (prin)

# Andor iDus InGaAs CCD



## Newport Plane Ruled Reflectance Grating



S Plane — P Plane — S&P Plane Average

#### **NIR Spectrometer Calibration**

#### Xe lamp spectrum before calibration



# **Fitting Process**

- Locate peaks, which were generated from Xe lamp, 532 laser and 633 laser, at 512<sup>th</sup> pixel and record pulse numbers.
- Plot pulses vs. central wavelength (nm), then fit the diagram with polynomial.
- Plot peaks wavelength(nm) vs. pixel number, then fit the diagram with polynomial.

#### Central wavelength fitting



## $\lambda$ vs. pixel



## Error

Peak location	Reading location after	orror
(nm)	calibraion (nm)	enor
823.1635	823.169	-0.0052
881.941	883.108	-1.1672
895.225	895.717	-0.4924
904.545	903.956	0.5887
916.265	916.200	0.0651
937.476	936.673	0.8026
951.338	952.416	-1.0782
979.97	979.167	0.8033
992.319	991.749	0.5695
1083.837	1084.446	-0.6086
1646.327	1646.040	0.2870
1669.364	1670.840	-1.4764
1763.882	1763.719	0.1628
1790.45	1790.000	0.4499
1809.09	1810.087	-0.9969
1832.53	1833.253	-0.7228
1959.94	1959.682	0.2583
1984.638	1984.309	0.3288
2026.2242	2025.837	0.3871
Standard d	0.717	

# Xe lamp spectrum after Calibration



# Manual of NIR Spectrometer Controller

Under Labview program with visa.

#### **NIR Spectrometer controller**



# **Spectrometer Initialization**

- 1. Select COM port number of PAT-001
- 2. Run program
- 3. Set Target temperature
- 4. Cool Down

Related bottoms and controls	Functions
RUN	Starting program. After "RUN", CCD and rotational motor will be initialized automatically . And serial number of CCD will show up.
Target	Setting target temperature
Cool Down	Cool down CCD
COM Port Number	Setting COM port number of RS- 232 adaptor

![](_page_15_Figure_6.jpeg)

### **Spectrometer Calibration**

Related bottoms and controls	Functions	
Grating Offset (pulses)	Offset grating's angle	
Detector Offset (nm)	Translationally move X-axis for further accuracy	
Calibrate	Setting target temperature	
Central To	Set wavelength which show up at 512 <sup>th</sup> pixel. (**Frames not centered at default value, 1500nm, are not well calibrated. Thus, we strongly recommend that do not change the value)	
SET	Move to frame centered at wavelength set above	
Monitor	Start monitoring spectrum	
RESET	Reset rotational motor if spectrometer was malfunctioned.	

![](_page_16_Figure_2.jpeg)

#### **Spectrometer Calibration Procedure**

- 1. Input light source
- 2. Start "monitor"
- 3. Press "Calibrate"
- 4. Set "Grating Offset"
- 5. Press "Calibrate"
- 6. Redo 4,5,6. Until you placed the peak at

512<sup>th</sup> pixel, then press "SET".

![](_page_17_Figure_8.jpeg)

2

#### **Spectrometer Calibration Procedure**

- For further accuracy
- After pressing "SET", one can input "detector offset" in nm to match value on X-axis to known peaks under wavelength display.

![](_page_18_Figure_3.jpeg)

### **Monitor Spectrum**

Related bottoms and Functions controls		x-axis change.vi Front Panel * Window Help
Auto scale	Auto adjusting maximum value and minimum value of Y-axis	
Scale (Once)	Auto adjusting maximum value and minimum value of Y-axis once	
Full Range	Restore reading on X- and Y- axis into default values	
Exposure(ms)	Exposure time. Minimum: 2µs.	
Boxcar	# of pixel for smoothing diagram	
Average	# of frame taken for averaging	
Frames	# of frame in one acquisition	
Wait	Duration between acquiring frame to frame	800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900
Monitor	Start monitoring spectrum	Auto Scale Full Range Exposure(ms) Boxcar Average Frames Wait Monitor Acquire Background
Acquire	Acquire datas	
Background	Acquire a data for eliminating noise from CCD itself	

# Monitor and Background

- Setting parameters
- Start "Monitor"

Background correction
1. Block light source
2. Press "Background"
\*\*Once turn off "Background", former background data will be eliminated.

![](_page_20_Figure_4.jpeg)

# Acquiring Data

- 1. Cancel "Monitor"
- 2. Input "Frame"
- 3. Input "Wait"
- 4. Press "Acquire"
- 5. After acquiring, if you are sure about the data, press

Exposure(ms)

Boxcar

Average

Frames

Wait

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"Save Data"; if not, press

"Abort".

![](_page_21_Picture_8.jpeg)

#### Shut Down

![](_page_22_Figure_1.jpeg)

Simply press "SHUT DOWN", and wait until the program stop running.

1