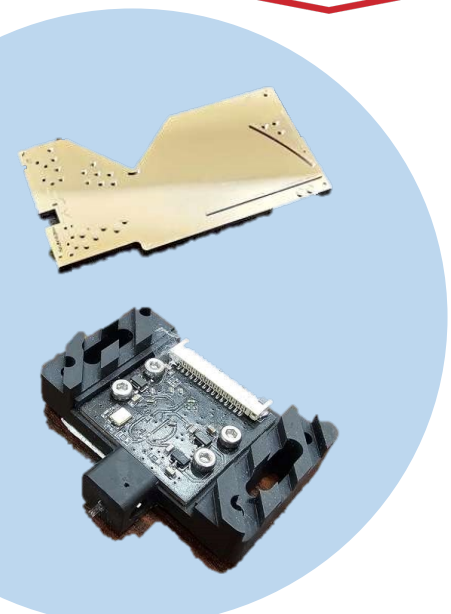
spectrochip

Bringing Changes in Full Spectrum

SpectroChip/SPU Modules & Solutions

Micro-spectrometers with Built-in SpectroChip Technology

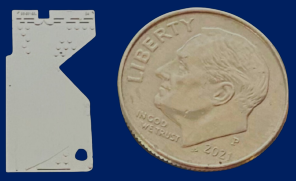
Eternal 長興材料 ETERNAL MATERIALS



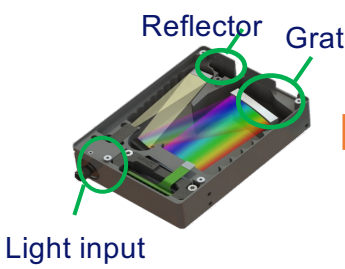
Applications: Biotechnology | Industrial | Environmental | Food Safety | Agriculture I Energy

SpectroChip – A Breakthrough Technology Revolutionizes the Field of Spectrometry

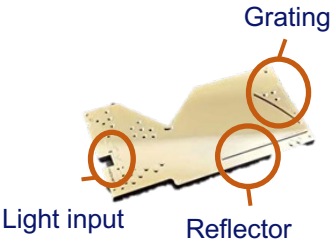
0.5 nm X-ray lithography to pack the full optical function of a spectrometer into a fingernail-sized chip



Mechanical Structure Spectrometer



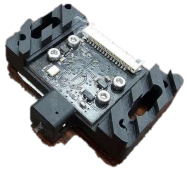
SpectroChip: Spectrometer on Chip



1.7 x 0.9 cm²

SPU: Spectrum Processing Unit

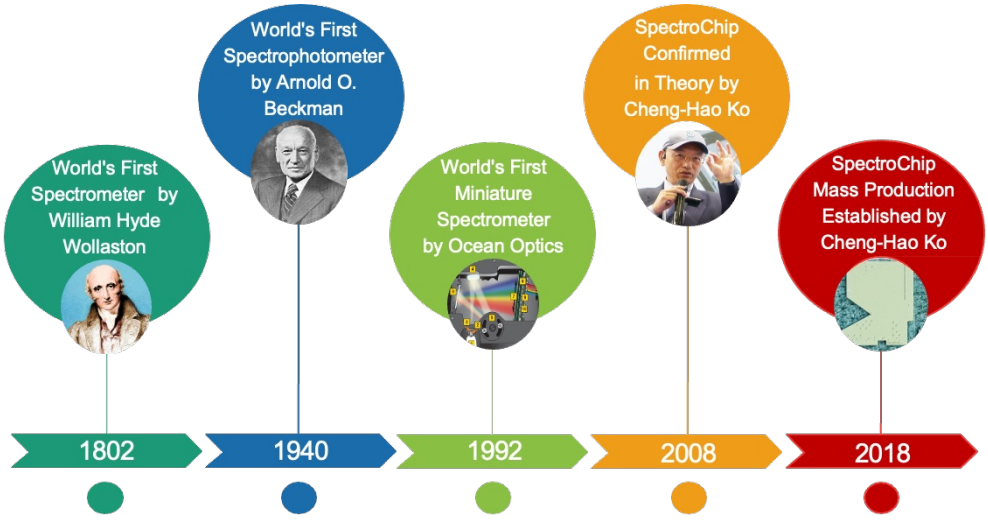
SpectroChip + Image Sensor



2.5 x 4.5 cm²

SpectroChip Advantages

- No assembly
- No alignment
- High accuracy
- High sensitivity
- Small form factor
- Monolithic wafer-based mass production



SpectroChip/SPU Technology– Offering Solutions and Services for Many Industries

The miniature form factor of SpectroChip & SPU modules enables compact designs of accurate spectrum sensors, as individual sensors or sensor hubs/arrays, in many applications. It also supports efficient integration with other systems including data security, communication, telemedical, IoT, AI chips, etc.

From simple plug-and-play spectrometer for school education or research purpose to complicated spectrum sensor hubs, SpectroChip/ SPU technology can provide unique solutions and services.

Modules in Pipelines

- **Micro VIS-NIR High Resolution Spectrometer**
- **In-situ Real-time Production Line spectrum Profiling Sensors**
- **Regular Detection Sensors (ppm or ppb level)**
- **High Sensitivity Detection Sensors (Sub-ppb levels)**
- **Compact Raman Spectrometers with SPU System embedded**

Milestones

2002:
Spectrometer SOC Project Start

2002-2017:
Developed SoC Spectrometer theory. Manufacture process development.

2018:
SpectroChip Inc (Taiwan) established.
Process precision: <1 nanometer
Technology patented in the United States & Taiwan.

2018-2022:
Taiwan FDA License (3 models). System validation & application development with medical centers in Taiwan. The One InstantCare system released. Ready for Covid-19 antibody test. USA FDA(510K) listed in December 2020.

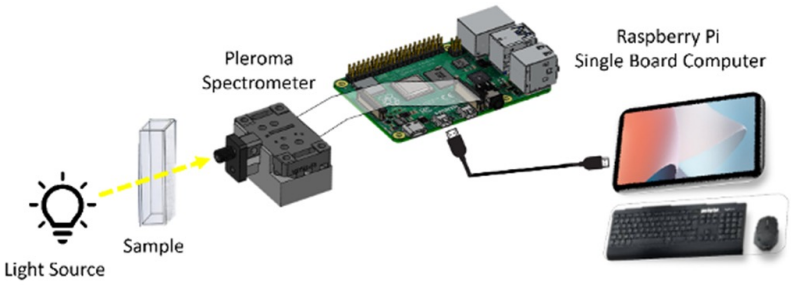
2023:
SPU System Inc (United States) was established.
Partnership and business development in various industries

Pleroma Micro-Spectrometer

SPU
Module 1

MSR-001

A SPU designed for Raspberry Pi applications.



Features

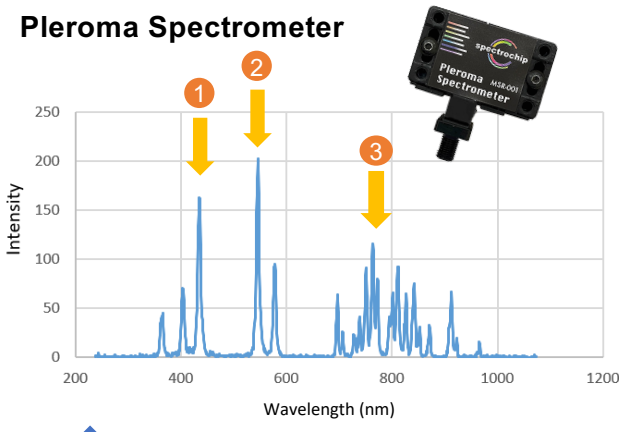
- Spectral range: 300-1000 nm
- Highly accurate optical characteristics
- Direct connection to Raspberry Pi SBC
- Python source code available
- Compact design for easy integration
- Compatible with SMA905 fiber connector

Specification

Optical	
Optical Module	SPU
Spectral Range	300 ~ 1000 nm
Spectral Resolution	5.0 nm
Spectral Accuracy	+/- 0.375 nm
Stray light	0.04%
Electrical / Mechanical / Dimension	
A/D conversion	8 bits
Integration time	0 ~ 1,000,000 μs
Data Interface	CSI camera connector
Power Consumption	158 mW
Image sensor	OV9281
Number of pixels	1280
Dimensions (WxDxH) / Weight (module only)	44 x 26.5 x 11 mm^3 / 12 g
Dimensions (WxDxH) / Weight (module + holder)	44 x 47.28 x 26.25 mm^3 / 50 g

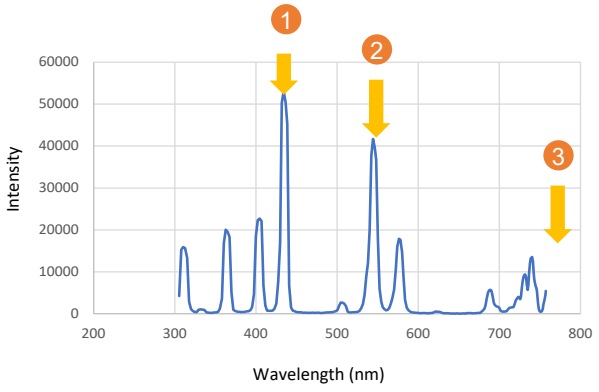
Spectral Performance

Hg-Ar Spectrum



Wider spectral range & better resolution

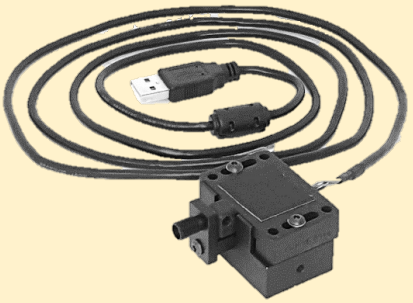
Other Micro-Spectrometer



SpectraPort Micro-Spectrometer

SPU
Module 2

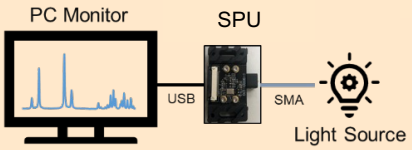
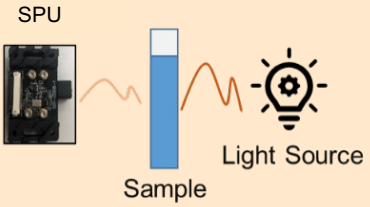
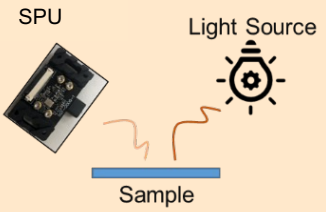
MSU-100



Features

- USB connector to PC / Mac
- Plug and play
- Compact
- Open-source imaging software
- Compatible for all OS
- Broad wavelength range
- High spectral resolution
- Real time monitor
- Diverse applications (Optics, Medical…etc)

Application Examples

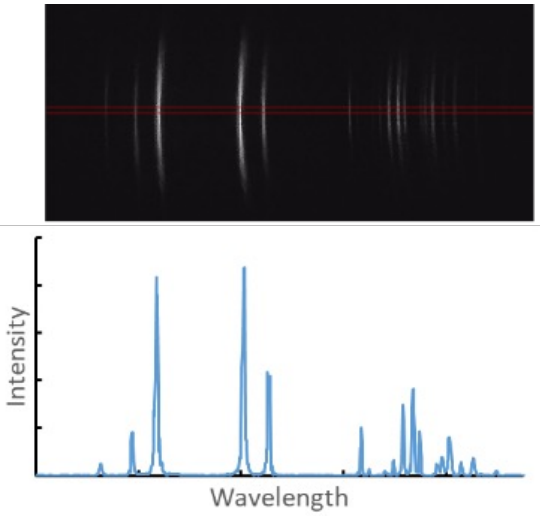
Emitting Spectrum	Transmission Spectrum	Reflection Spectrum
		

Model Number	MSU-100
Wavelength range	300 ~ 1000 nm
Spectral Resolution	5 nm
Spectral Accuracy	+/- 0.375 nm
Stray light	0.04 %
Image sensor	OV9281 Mono
A/D Conversion	8 bits
SNR_{max}	6000 (38 dB)
Dynamic range	6 x 10^6 (68 dB)
Optical connector[*1]	SMA905
Measurement time	10 Hz[*2]
Working temperature	5 ~ 35 ℃
Connector type	USB
Dimensions (WxDxH) / Weight (module only)	44 x 26.5 x 11 mm^3 / 12 g
Dimensions (WxDxH) / Weight (module + holder)	44 x 47.28 x 26.25 mm^3 / 50 g

*1 Switchable to other types of optical connectors.
*2 Depending on system performance.

Illustration

High sensitive detection of atomic spectrum from Hg-Ar light source



Point-of-Care Testing:
The ONE InstantCare Device

Application Note 1

MA-100

The ONE InstantCare Device is a SPU-based LFIA[*1] analyzer for accurate quantification of rapid diagnostic test. It covers a wide spectral range from 300 to 1000 nm with a spectral resolution of 5 nm and an accuracy of 0.5 nm. It turns qualitative test into a quantitative measurement and enhance detection sensitivity.

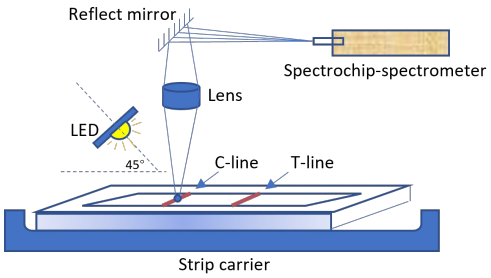
Features

- High sensitivity: LOD[*2] down to sub ppb
- Spectral range: 300-1000 nm
- Easy operation with mobile Apps
- Rapid quantitative result in 10-15 mins
- Portable for any test site applications

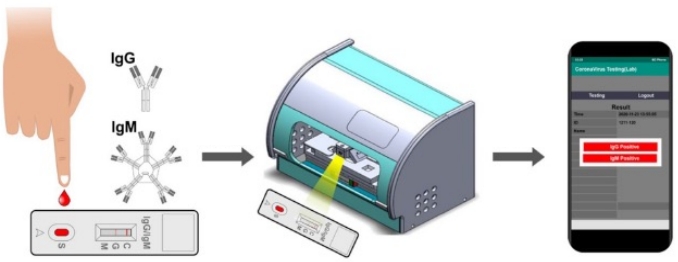
Applications

- Healthcare management / POCT tests
- Component analysis in food, agriculture, veterinary industries, etc.
- An open-platform chromatogram reader that works with various LFIA tests under different commercial brands.

Principles



Operation Flow



Specification

Optical	
Optical Module	SPU
Principle	Flat-field micro concave grating
Spectral Range	300 ~ 1000 nm
Spectral Resolution	5.0 nm
Spectral Accuracy	0.5 nm
SNR	2400:1 (33.8 dB)
Stray light	0.04%

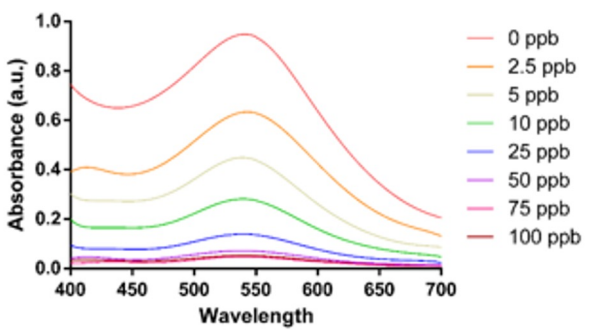
Biological	
Platform	LFIA Rapid Diagnostic Test
Turn-around Time	~ 10 mins
Specimen	Finger-tip Blood (10 ~ 100 μL)
Sensitivity: LOD	ng/mL (ppb)~ pg/mL (ppt)
Electrical / Dimension / Weight	
Power Interface	USB Mini
Data Interface	Micro USB / Bluetooth
Power Supply	≥ 12-Watt USB Power Adaptor
Dimension	16 cm x 10.5 cm x 12 cm
Weight	700 g

*1. Lateral flow immunoassay
*2. Limit of detection

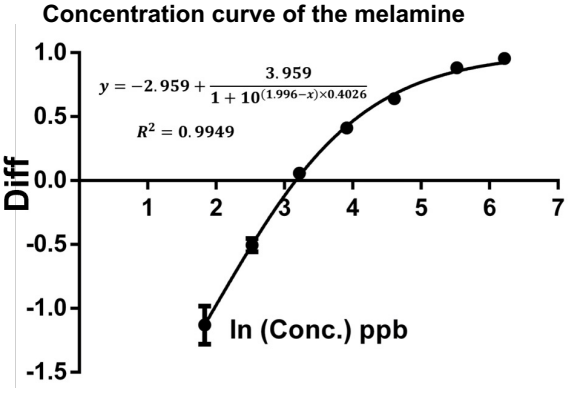
Spectral Performance

Absorbance spectrum performance of melamine test

Absorbance spectrum of melamine test strip (T line)



Concentration curve of the melamine



POCT Assays Tested with The ONE InstantCare Device

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Virus
- Dengue
- COVID19
- Flu
- EV
- HIV
- HPV

Cardiac Tests
- Troponin-T / Troponin-I
- CK-MB
- D-Dimer
- NT-proBNP
- CRP

Inflammation
- CRP
- PCT
- IL-6
- SAA

Veterinary
- FPV
- CDV
- CPV
- TOXO IgG/IgG

Routine Urinary Tests
- Urine protein
- Occult blood
- Nitrites
- Specific gravity
- pH
- White blood cells
- Urine sugar
- Ketone bodies
- Bilirubin
- Urobilinogen
- Microalbumin
- Creatinine

Chronic diseases
- HbA1C
- Total cholesterol
- HDL
- LDL
- Triglycerides,
- Blood glucose
- Creatinine

Controlled Substances
- Drug
- Paraquat
- Heavy metal
- Food safety test (melamine/ractopamine)

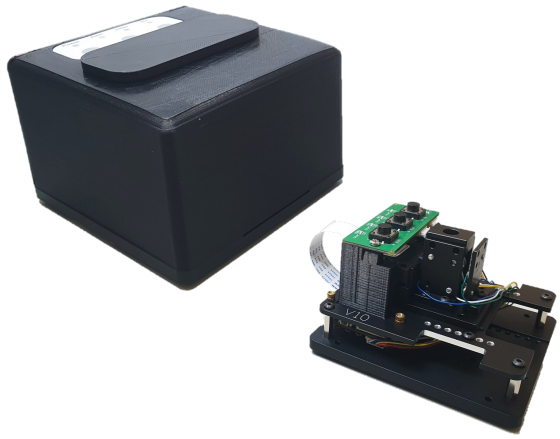
Spectro-Engine

Biochemical Analyzer

SE-100

Application Note 2

Spectro-Engine is a compact, lightweight spectrophotometer with a wide spectral range and high resolution capabilities. It is versatile, suitable for analyzing transmission, absorbance, and fluorescence in chemical materials. It can also function as an embedded system for various industrial testing needs.



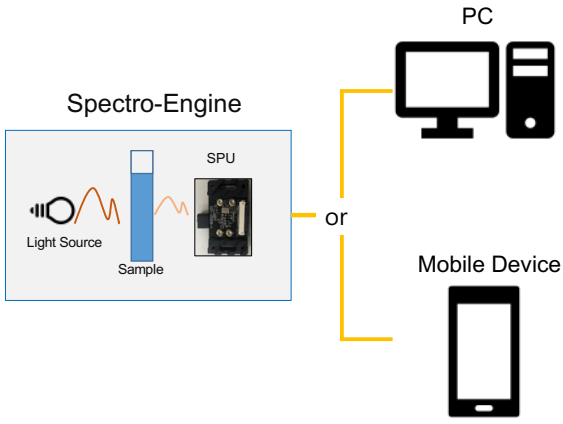
Features

- Spectral range: 300 ~ 1000 nm
- Easy operation with mobile phone App
- Reads absorbance and fluorescence
- Portable for any test site applications

Applications

- Chemical analysis
- Academic and pharmaceutical research
- Environmental monitoring
- Material characterization
- Food and beverage analysis

Configuration Example



Specification

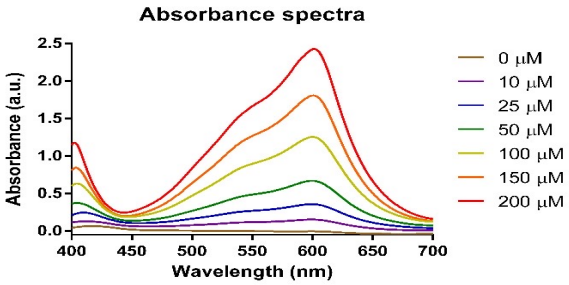
Optical	
Optical Module	SPU
Detection Type	Transmission, Absorbance, Fluorescence Spectrum
Spectral Range	300 ~ 1000 nm
Resolution	5.0 nm
Spectral Accuracy	0.5 nm
Light Source	UV LED (Peak~345nm)
	Cyan LED (Peak~500nm)
	White LED (400~700nm)
SNR	2400:1 (33.8 dB)
Dynamic Range	4096:1 (36.1 dB)
Stray light	0.04%

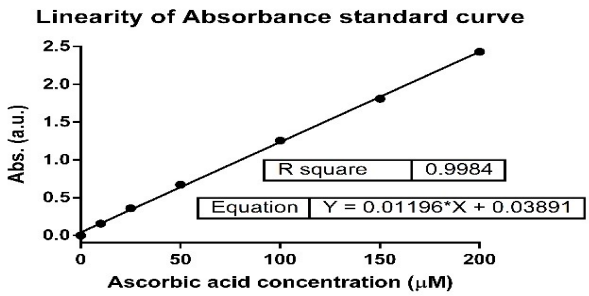
Biological	
Sample Vessel	200 µL, 600 µL 1cm cuvette, 3cm cuvette
Turn-around Time	4 seconds
Sensitivity: LOD	OD accuracy: <1% at 2.0 OD OD repeatability:<0.5% at 2.0 OD
Electrical / Dimension / Weight	
Power Interface	Micro USB (5V/2.4A)
Data Interface	Mini USB / Bluetooth
Power Supply	≥ 12-Watt USB Power Adaptor
Dimension	11 cm x 10 cm x 7 cm
Weight	430 g

Spectral Performance

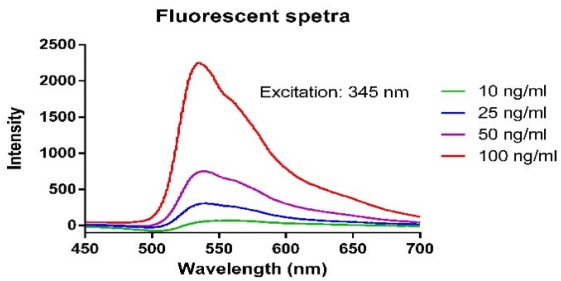
Absorbance	Fluorescence

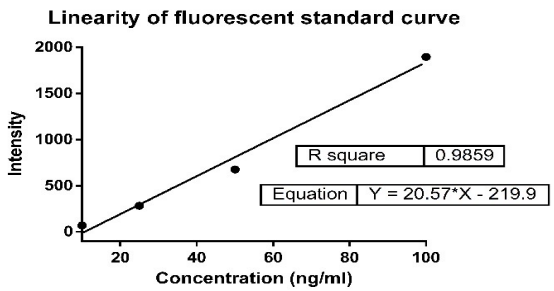
Vitamin C





Tonic water





Test Examples

Chemical Analysis

- Total antioxidant capacity assay
- Bicinchoninic acid (BCA) protein quantitation assay
- dsDNA broad range quantitative fluorescent assay
- Lactoferrin fluorescent assay

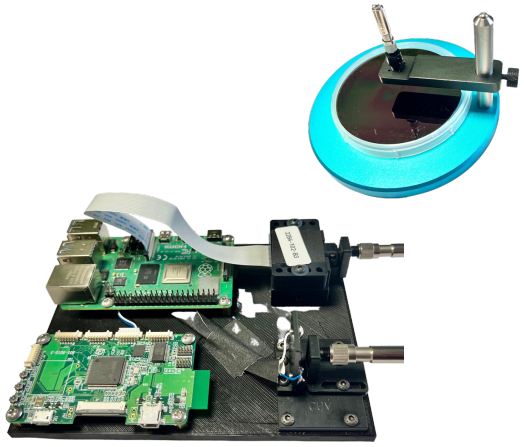
Environment Monitoring

- Copper ion level in liquid
- Silica (SiO_2) level in liquid

Optical Thin Film Thickness Measurement

Application Note 3

MST-100

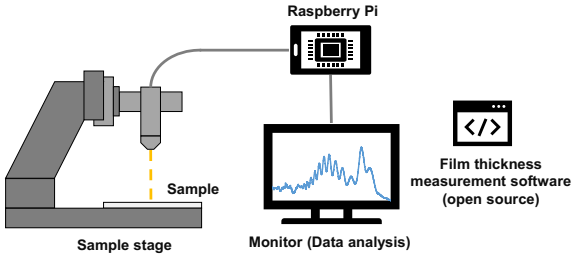


In this application, SPU module is used for optical thin film thickness measurement. It can measure film thicknesses above 1 μm. Open-source software for this system is readily available on the Raspberry Pi platform, allowing easy integration into inspection systems for various applications.

Features

- Simplified measurement
- Python source code available
- Compact
- Compatible for Linux platform (Raspberry Pi)
- Real time monitor for interference pattern

Configuration Example



Specification

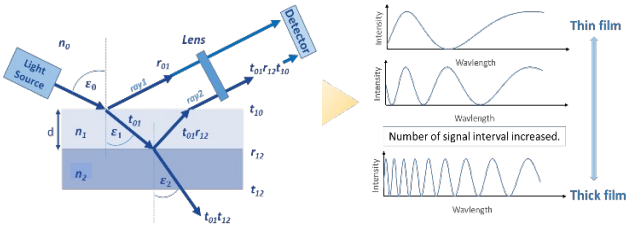
Model Number	MST-100
Measurement film thickness range	> 1 um
Light source	LED
Measurement wavelength range	300 ~ 1000 nm
Measurement reproducibility	0.5 nm
Working distance[*1]	10 mm
Spot size[*1]	Approx. Φ1 mm
Measurement time[*2]	10 Hz
Power supply voltage[*3]	AC100-240V, 50-60Hz
Light guide connector	SMA905 / FC-PC

*1: Depending on optical system or objective lens magnification to be used
*2: Depending on user's performing environment
*3: Depending on model of used Raspberry Pi

Principles

Interference spectrum is used to determine film thickness.

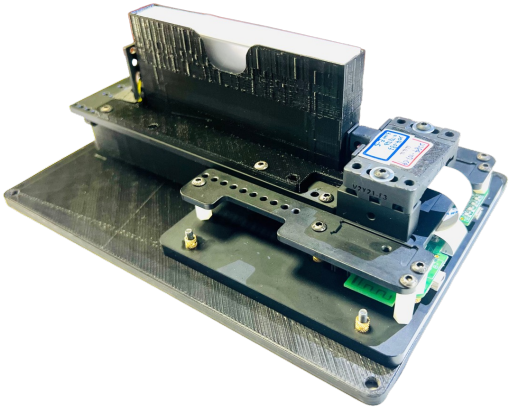
White light is directed onto the sample, producing a characteristic spectrum influenced by the film's thickness. Through analyzing the interference spectra, the film thickness can be determined.



Measuring Silica Contamination in Ultra Pure Recycling Water

Application Note 4

MSW-100



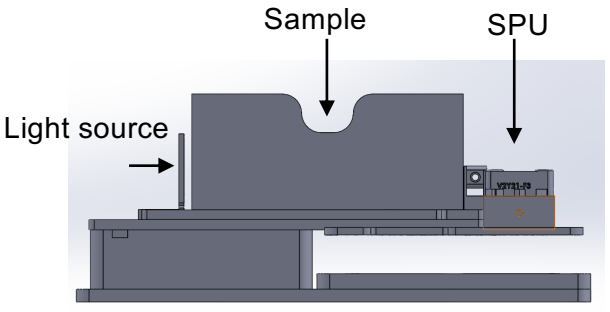
Features

- Simplified measurement
- Compact
- Real-time monitoring
- Broad wavelength range
- High spectral resolution
- Diverse applications in water quality measurement

Applications

- Semiconductor manufacturing
- Power plant operation
- Water purification
- Environmental monitoring
- Laboratory and research settings

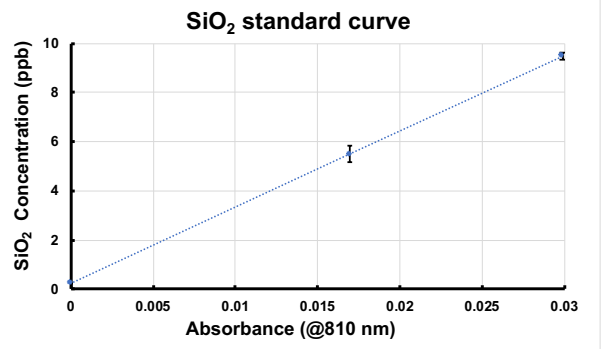
Configuration Example



Specification

Model Number	MSW-100
Wavelength range	300 ~ 1000 nm
Spectral resolution	5 nm
Spectral accuracy	0.5 nm
Stray light	0.04 %
Image sensor	CMOS (AR0130) A/D 12 bits
Light source	LED: 810 nm
Optical path	100 mm
Measurement precision	+/- 0.07 ~ +/- 0.25 ppb
Detection principle	Molybdenum blue method
Measuring range	ppb ~ ppm range
Measuring time	10 seconds
Dimensions (W×D×H)	200 × 140 × 95 mm^3
Weight	750 g

Spectral Performance



Precision:
5 ppb +/- 0.18 ppb
10 ppb +/- 0.07 ppb

Bringing Changes in Full Spectrum

Empowering Industries with SpectroChip Technology

- **45 Related Patents in USA & Taiwan**
- **FDA 510(k) Registration / TFDA Certification of Modules/Devices**
- **Awards and Recognitions:**
  - **Innovation / Special / Gold Awards, Malaysia Technology Expo 2023**
  - **Top 3 Best Startup, World Cup Taiwan 2022**
  - **2021 International Innovation Awards, Enterprise Asia**
  - **2020 Taiwan National Innovation Award**
  - **2018 & 2019 Taiwan National Scientific Breakthrough Award**
  - **2018 & 2019 Taiwan National Most Popular Science Award**

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