C112-E013C

SHIMADZU
Excellence in Science

Optical Emission Spectrometer

PDA-8000

PDA-8000

Optical Emission Spectrometer

A Spark for a New Dimension

A New Design of Spectrometer with Higher Stability

High accuracy and stability measurement achieved by the latest optical design

A Novel Excitation Unit

Equipped with real-time energy monitoring

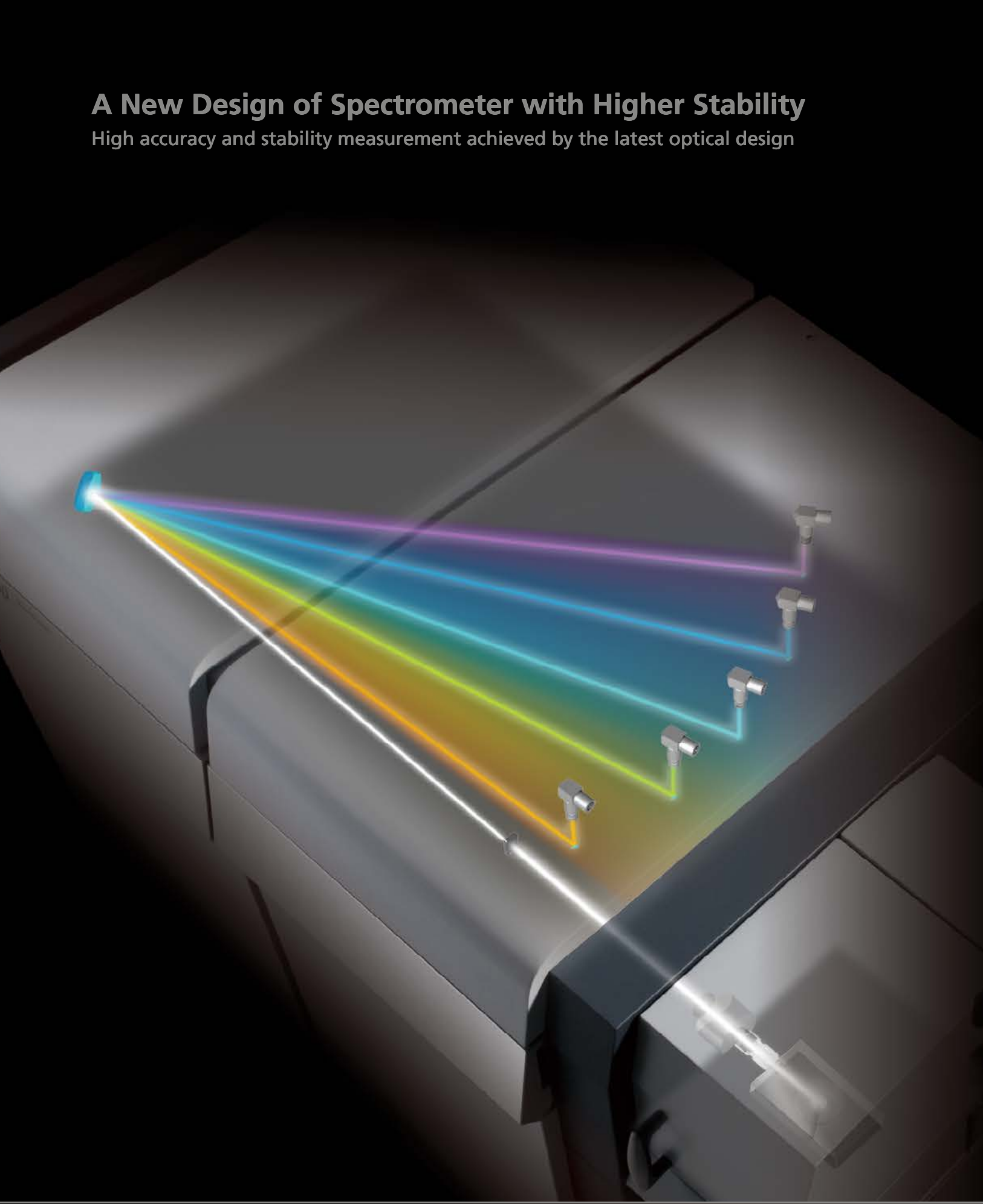
Sophisticated Software

Total support for control and management of the instrument with an intuitive interface

Contents

A New Design of Spectrometer with Higher Stability

High accuracy and stability measurement achieved by the latest optical design



More Precise Analysis Achieved with a High-Resolution Spectrometer

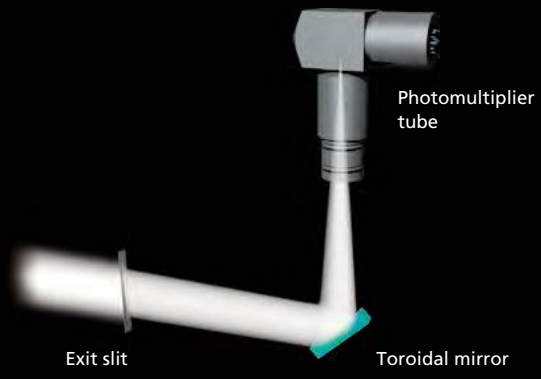
Using a Paschen-Runge Spectrometer with the focal length of 1000mm, and a diffraction grating suitable for each of ferrous or non-ferrous application, PDA-8000 offers high-resolution measurements with less spectral interference over a wide wavelength range.

Stable and Proven Vacuum Spectrometer

Oxygen inside the spectrometer needs to be removed because it absorbs spectral lines in the vacuum-ultraviolet wavelength range, and some important elements in material analysis have spectral lines in this range, including Phosphorus, Sulfur and Nitrogen.
PDA-8000 uses a proven vacuum monochromator to provide stable spectroscopic analysis.

Light Detector Condensing System

Light passed through the exit slit is focused on the photosensitive surface of a photomultiplier tube by a toroidal mirror. This optical design enables stable measurement.



High Responsiveness to Changes in the Environment

The spectrometer is made from materials that change little with temperature. In addition, by being located in the thermostatic chamber with enhanced thermal insulation performance, changes in the ambient temperature do not affect the instrument, permitting more precise analysis. (Ambient temperature 15 to 30 °C, ±5 °C/hour max.)

Main Fields of Application

Iron and steel

Aluminum base metal, rolling industry

Cast iron

Other metals

- Quality control by rapid analysis in the furnace at each manufacturing stage
- Analysis to determine compliance with standards
- Materials receiving inspection

Machinery, Automotive, Shipbuilding

- Analysis to determine compliance with standards
- Materials receiving inspection

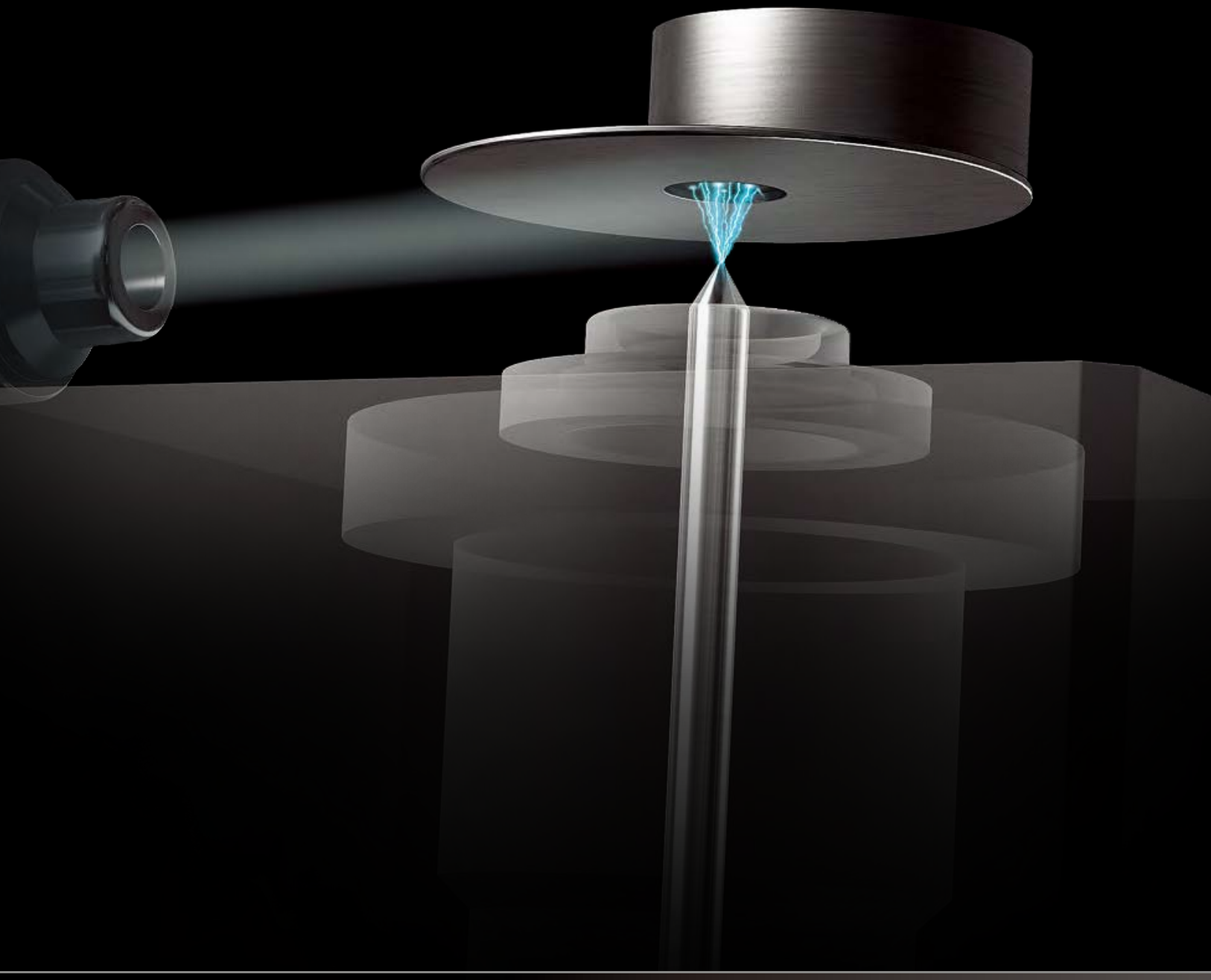
Table of Elements that can Be Measured

Measurable

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	*L	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	**A															
		*L	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
		**A	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

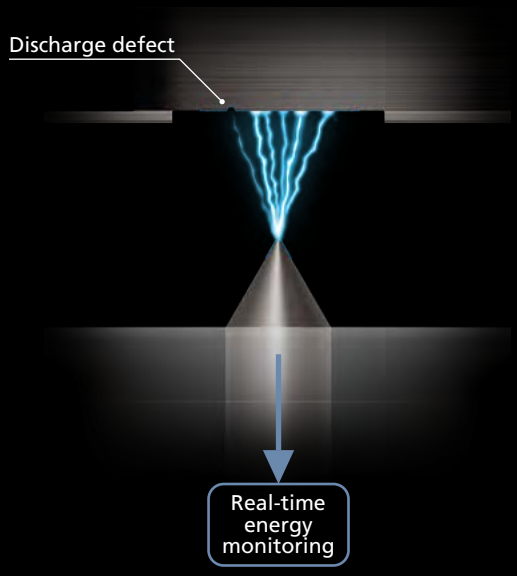
A Novel Excitation Unit

Equipped with real-time energy monitoring



Constant Monitoring of the Discharge Status

A Realtime Energy Monitoring* function is provided to monitor the discharge energy consumed between the counter electrode and the sample. The discharge energy is accurately set and controlled, and discharge defects due to the surface condition of the sample can be instantly detected from the discharge energy. The accuracy is improved by eliminating samples with defects from the measurement.
*Patent pending

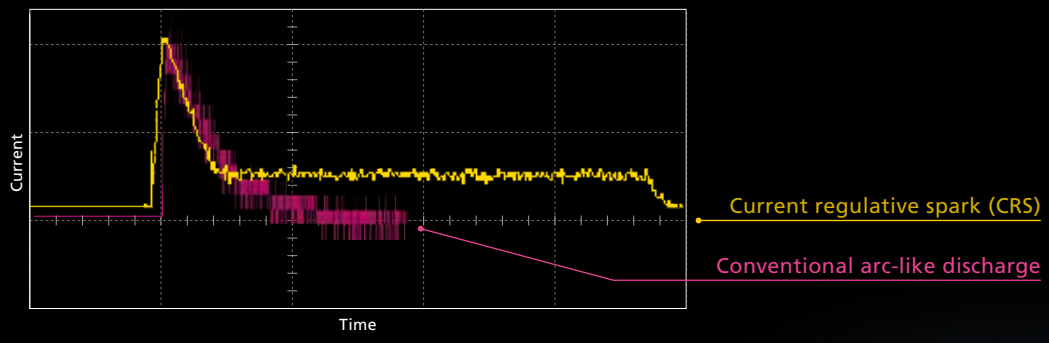


Supporting Diverse Metal Materials

Many metal materials can be analyzed over a wide range of optimal discharge conditions, such as high-energy discharge for metals like steel with a high melting point, or low-energy discharge for metals like lead and zinc alloys with a low melting point, through the use of a newly-developed discharge energy stabilizing excitation unit.

Ultra-Trace Analysis of High-Purity Materials

Current Regulative Spark* (CRS) which is capable of stabilizing the current for every pulse, improving sensitivity for trace amounts.
*Patent pending



Energy Efficient Design

The power consumption is reduced to 510W (43 % reduction from our previous Optical Emission Spectrometer)*1

*1 For analyzing 15 samples/hour

eco

The argon gas consumption is also reduced by about 45 % from our previous Optical Emission Spectrometer.*2

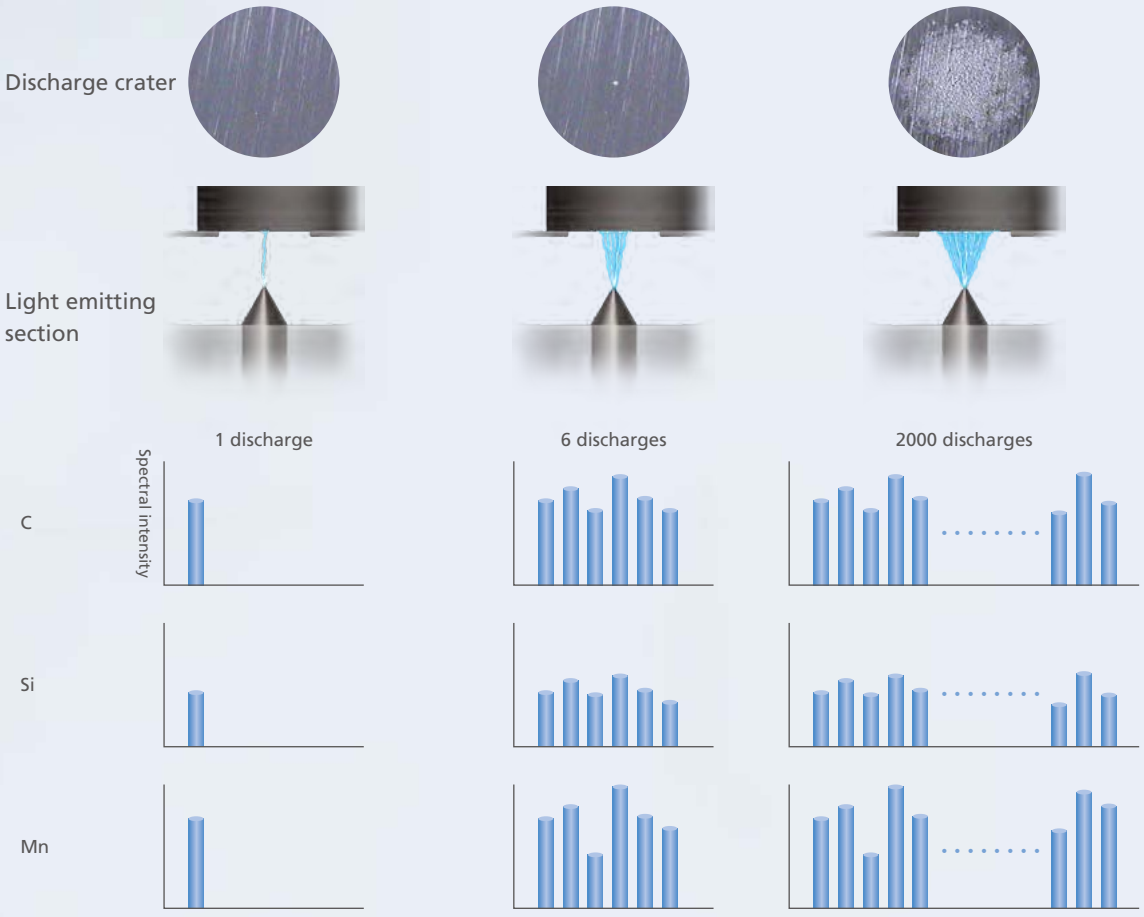
*2 The consumption for analyzing 150 samples/8 hours in 1 day

*Discharge spot

Shimadzu's Unique Pulse Distribution Analysis Photometry

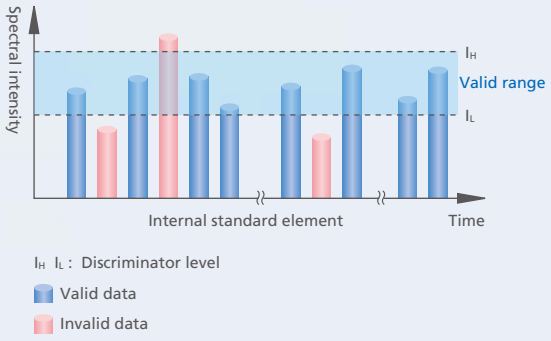
Pulse Height Distribution Analysis (PDA) Method Provided as Standard

The spectral intensity signal from the detector obtained for each pulse discharge is fed in for each analysis element, and converted into a frequency distribution. By performing statistical processing appropriate for each analysis element, the measurement accuracy can be improved and information on the element form can be extracted.



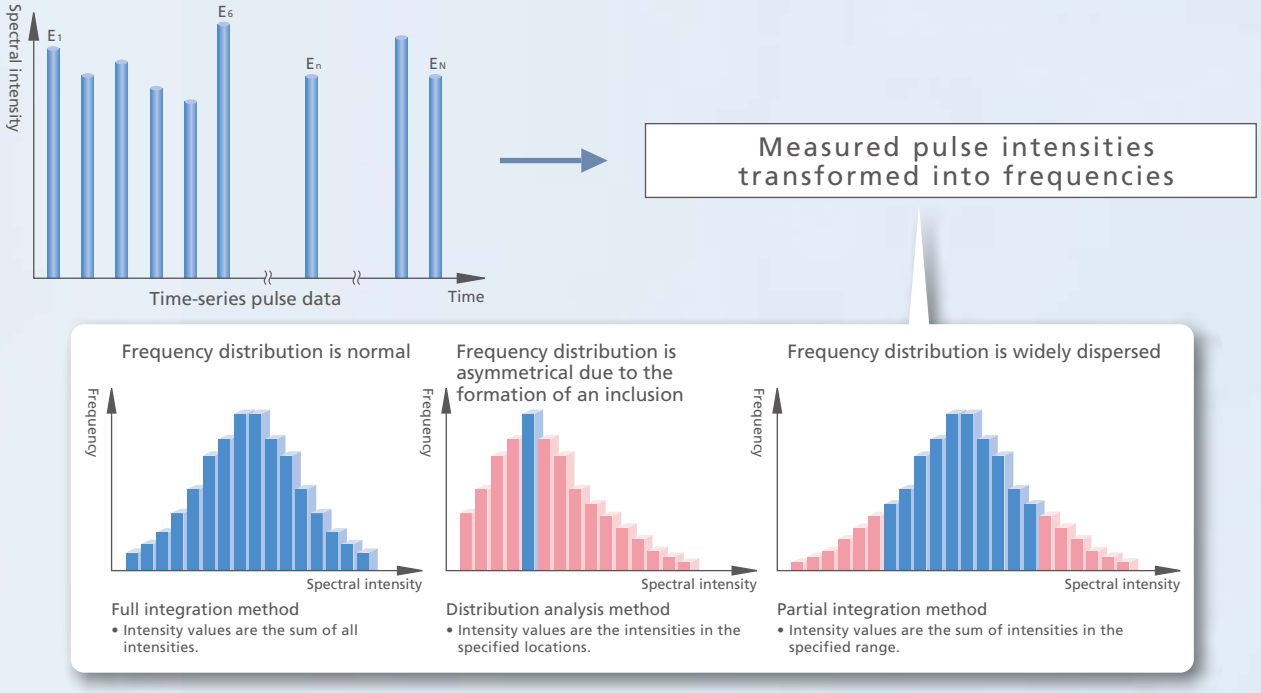
Internal Standard Element Monitoring

The spectral intensity of internal standard elements is monitored, and only pulses with the intensity within the specified range are processed as valid. Increased accuracy is achieved by eliminating the data outside the range from the statistical processing.



Frequency Distribution Processing

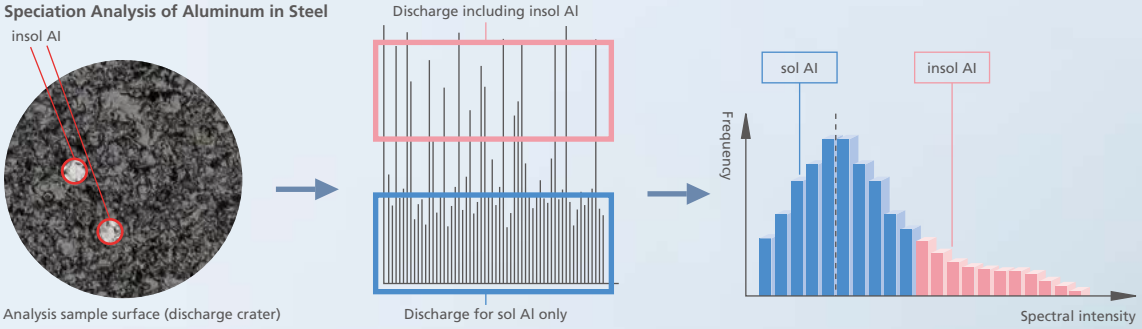
Unlike conventional emission spectrometry that integrates the spectral intensity, Shimadzu's unique PDA method performs frequency distribution processing on the spectral intensity of each discharge pulse.
For example, when a discharge spot is applied to inclusions such as manganese sulfide (MnS) or aluminum oxide (Al_2O_3), the spectral intensity of that element is increased. When the spectral intensity of elements that readily form inclusions is converted into a frequency distribution, the distribution form is not symmetrical. For these elements that readily form inclusions, accurate results can be obtained by eliminating the data in the high intensity range from the statistical processing as inclusion data, using the distribution analysis method. For elements that do not form inclusions, the shape of the frequency distribution is symmetrical. Accuracy can be improved by selecting a processing method suitable for each element, such as the integration method that integrates all the spectral intensity, or the partial integration method that divides the spectral intensity.



Metallographic Analysis

There are 2 forms of aluminum in steel: aluminum oxide (Al_2O_3: insoluble Al) existing as particles with diameters about 5 µm, and metallic aluminum (soluble Al).
The spectral intensity increases if aluminum oxide exists within the discharge spot.
After converting to a frequency distribution, information on aluminum oxides can be obtained from the part of the distribution with high spectral intensity.

Speciation Analysis of Aluminum in Steel

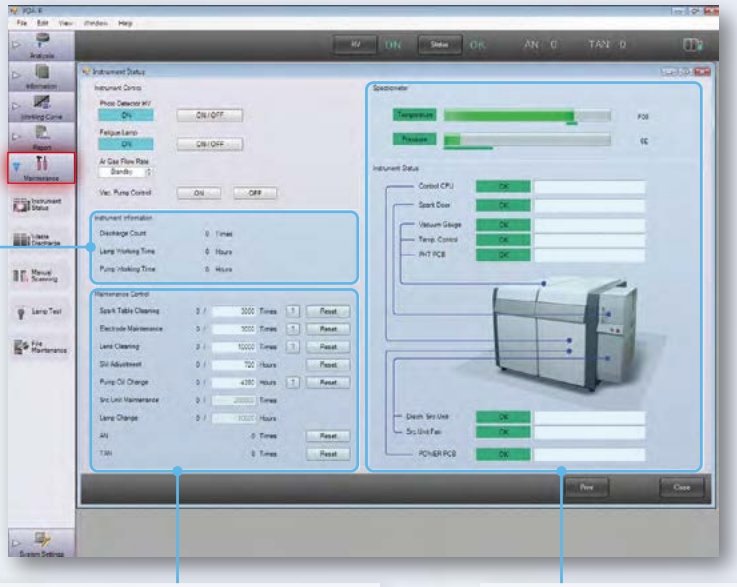


Intuitive Software PDA-R

Total support for control and management of the instrument with an intuitive interface

Fusion of Hardware and Software

From control and diagnosis to maintenance—reliable instrument management with software integrated with the hardware.



The operating time of each part is controlled by each unit, so there is no problem when replacing PCs. Of course, they can be easily checked with the software.

The software supports complete maintenance management for stable use of the instrument.

- Lens cleaning procedure
- Pump oil replacement
- Electrode replacement
- Entrance slit adjustment
- Emission table cleaning
- Lamp replacement

Instrument status displayed in real-time, down to the details.

- Instrument control system
- Monochromator temperature and pressure
- Excitation unit
- Vacuum meter
- Photometer
- Temperature adjustment system

When maintenance is required...

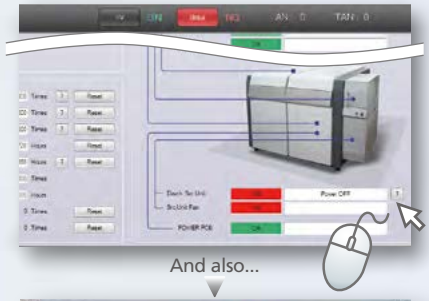
The software notifies you

And also...

Maintenance procedures are also supported. The instructions on the support screen provide guidance on the operations.

When troubles occur

The software warns you



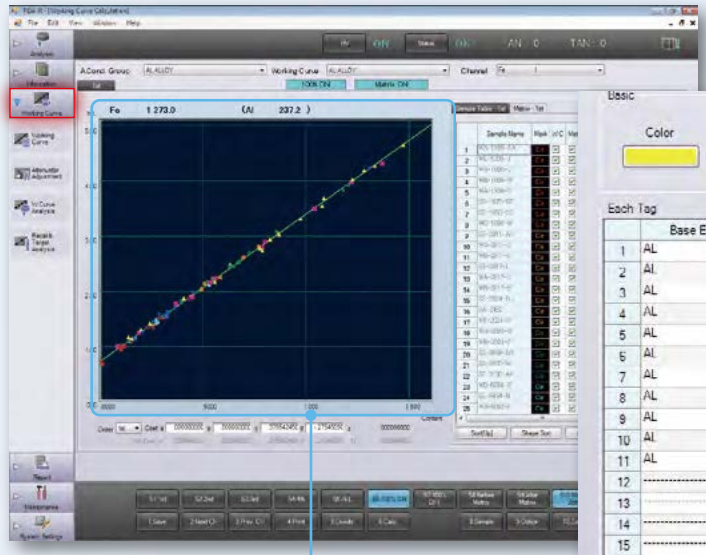
And also...

Abnormalities are automatically diagnosed and remedial measures are displayed.

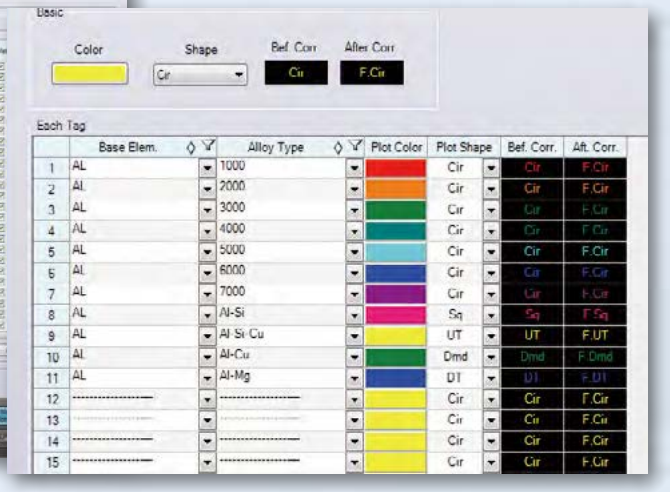
The Pursuit of Greater Ease-of-Use, Based on Reliability

A sophisticated, operator-friendly design has been developed utilizing our cumulative emission spectrometry experience.

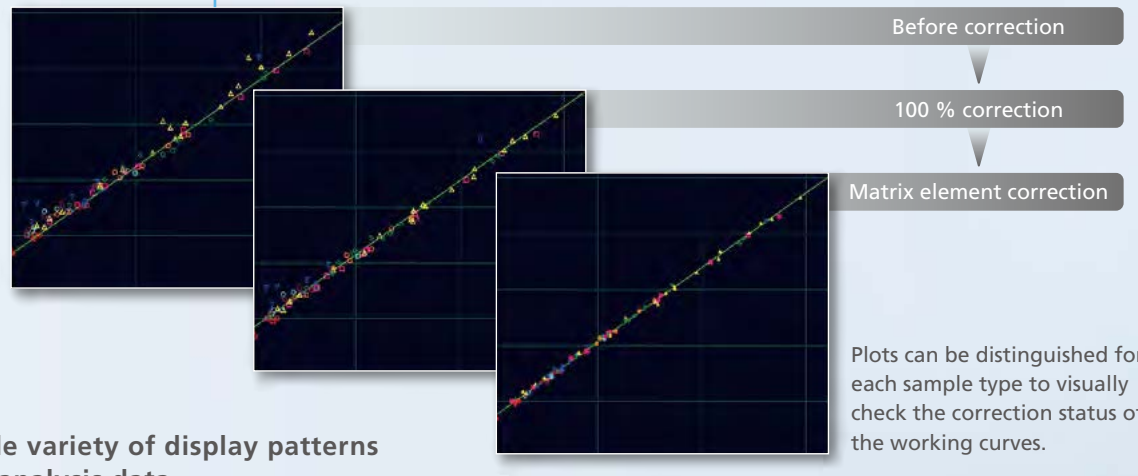
Plots can be set for each sample, with more intuitive and easy-to-understand operation



Working curve setting screen

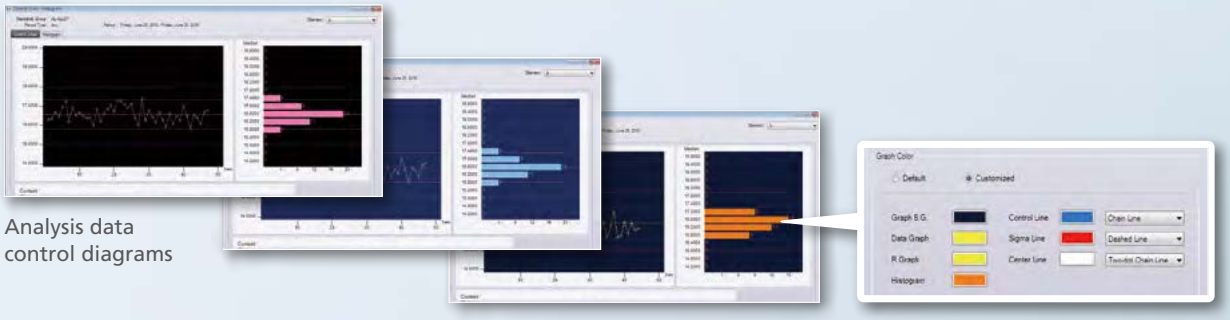


Working curve plot setting screen



Plots can be distinguished for each sample type to visually check the correction status of the working curves.

Wide variety of display patterns for analysis data



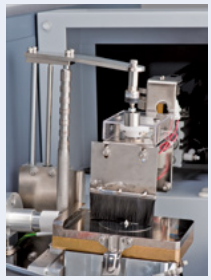
Analysis data control diagrams

Display pattern setting

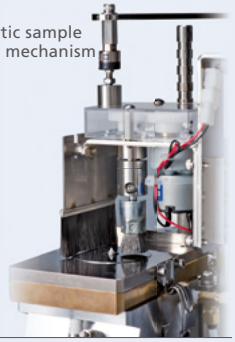
Options

Electrode-Cleaning Unit
(P/N 211-78278-92)

To enhance long-term stability, the optional electrode-cleaning unit keeps the counter electrode clean by brushing away adhering sample deposits.



Automatic sample retainer mechanism



Stand Water-Cooling Kit
(P/N: 211-78899-92)

Used to reduce the effect of the heat energy generated by high-energy discharge. A separate cooling water circulator is necessary.

Cooling Water Circulator
(P/N 044-01809-10)

Small Sample Kit
(P/N: 211-78904-**)

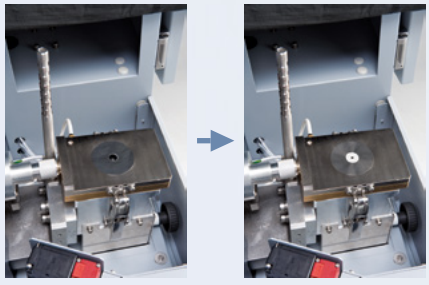
Handles samples between 3 mm and 12 mm in diameter.

Sample diameter

ø3 mm or more	P/N 211-78904-02
ø4 mm or more	P/N 211-78904-03
ø5 mm or more	P/N 211-78904-04
ø6 mm or more	P/N 211-78904-05
ø7 mm or more	P/N 211-78904-06
ø8 mm or more	P/N 211-78904-07
ø9 mm or more	P/N 211-78904-08

* When ordering multiple parts at the same time or adding to the existing instrument, the emission table and the Mylar in each small sample kit can be used in common, so only obtain the insulating washer for each hole diameter (P/N 211-78907-02 to 08).

(1) Emission table
(2) Insulating washer
(3) Mylar



Pin Sample Kit
(P/N 211-78901-92)

Handles wire or bolts between 0.6 mm and 12 mm in diameter.

Pin Sample Holder
(P/N 202-40597-)**

* Various types of pin sample holders are available. Select the specification to suit the sample diameter.

Consumables

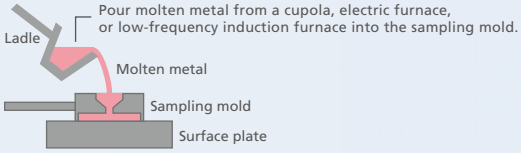
1. Tungsten Electrode	P/N 211-78953-91
2. Brush	P/N 211-74965
3. Pump Oil, 1 liter	P/N 017-30159-03
4. Grinding Wheel (for MT-11M)	P/N 085-50802-51

Options for Sample Preparation

Sampling Mold
(P/N 210-00005)

Surface Plate
(P/N 210-00006)

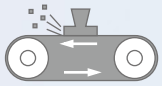
Size: W300 × D300 × H100 mm



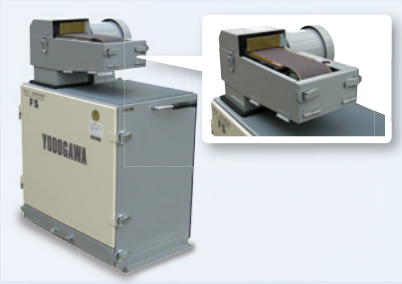
Mushroom type

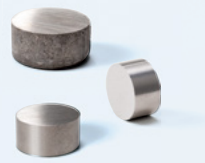
FS-3N (Special)
Belt Grinder with Dust Collector
(50 Hz: P/N 085-50206-15)
(60 Hz: P/N 085-50206-16)

Size: W441 × D680 × H883 mm
Weight: Approx. 97 kg
Power Supply: 3-phase 200 V 1150 W



Belt grinder



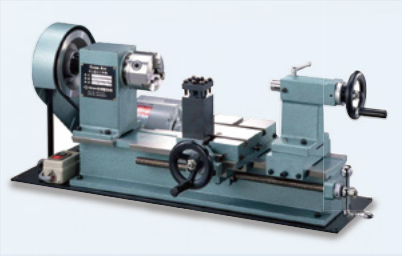


Disk type

L-1000 MM-02 Bench Lathe
(P/N 085-50102-02)

Size: W770 × D420 × H350 mm
Weight: Approx. 75 kg
Power Supply: Single phase 100 V 300 W
Order the following 1) and 2) with the bench lathe.

1)Tip holder TCGCR/L1010F-08
P/N 085-50102-12
2)Tip for non-ferrous TCGT080202FR/L-U KW10
P/N 085-50102-13
3)E-17 Bench Lathe Stand
P/N 085-50102 -11
Size: W1200 × D600 × H740 mm



Pechiney type

MT-11M Counter Electrode Grinder
(for 6 mm diameter tungsten electrodes)
(P/N 085-50802-02)

Size: W120 × D210 × H150 mm
Weight: Approx. 3 kg
Power Supply: Single phase 100 V 100 W

Standard Analysis Samples

Contact your Shimadzu representative for information on the selection and preparation of standard samples for each analysis purpose.

Automatic Analysis System

The optimal system can be configured by combining with sample preparation units to suit the customers' needs.
A 6-axis multi-articulated robot is used for sample handling to perform automatic analysis rapidly, efficiently, and safely.
The instrument performs automatic calibration to always maintain the optimal condition.

Sample ID registration → Start instruction → Sample preparation → Sample handling → Surface inspection → Analysis → Analysis results transmission → Storage according to sample type/ analysis results

Example of process analysis sample ID input screen

Set the sample ID in accordance with guidance.
The processing status of each analysis sample and the instrument status are displayed.
The PC type and the touch panel type are available.

Handling robot

Samples after preparation are handled by robot.

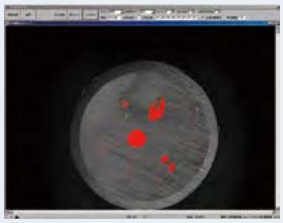
Sample stocker

This is a stocker for calibration samples or process samples.
Each table is designed not to contaminate the sample analysis surface.
The instrument automatically performs calibration analysis when required to always maintain the optimal condition.
Sample preparations are automatically performed while controlling the analysis position of each sample.
The stock process samples can be analyzed in sequence.

Inspecting the analysis surface

Defects on the sample analysis surface are detected by image processing.The handling robot is controlled to avoid the defects and perform the analysis in the optimal position.Defective samples are discarded without being analyzed to eliminate unnecessary analysis.

Optimal position detected by image analysis



Setting sample in the spectrometer and starting analysis

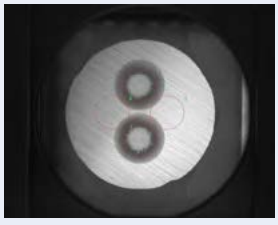
The optimal analysis position is automatically detected and analyzed in accordance with the sample shape and external diameter. Also, the analysis is performed a maximum of fourtimes, while checking the variation in the analysis values.
Between analyses, the electrodes are automatically cleaned to always maintain the optimal analysis condition.

Automatic cleaning of electrodes

Printing sample ID on the sample

After analysis, the sample ID is printed on the sample for easy identification.
Printing methods include applying a label, and direct printing such as inkjet or laser marking.

The condition of the analysis crater and the analysis positions can be stored as image data.



Specifications

Spectrometer Unit	Optical system	Paschen–Runge mount
	Monochromator	With temperature control
Excitation Unit	Excitation unit	REM power supply
	Emission table	Argon gas atmosphere
Software	No. of processing channels	64 channels max.
	Standard sample registration	10000 samples max.
	Matrix element correction	32 elements max./element
	Correction	100 % correction
		Master curve correction
	Analysis function	Content analysis (four-time analysis, round analysis)
	Analysis processing	Recycling
		Additional analysis
		Canceling
		Ending
		Display/print order and number of digit settings
	Analysis result transmission	RS-232C
		LAN (TCP/IP)
	Analysis results display	$\bar{X}$-R control chart
		Histogram
	Maintenance	Maintenance period control
	Password	Protection of analysis information

Installation and Optional Accessories

Installation Environment

Temperature : 15 °C to 30 °C

Humidity : 70 % max.

Power Supply : Single phase 200 V ±10 % 50/60 Hz 1.5 kVA

Installation : Separate, 30 Ω max.

Argon Gas : Purity 99.999 % min. Dew point –70 °C max.
A switching system with 2 or more 7m³ cylinders is convenient

Optional Accessories

(Installation spaces and power supplies are required separately.)

- Sampling Mold and Surface Plate
- L-1000 Bench lathe : Single phase 100 V 300 W
- Belt Grinder with Dust Collector : 3-phase 200 V 1150 W
- MT-11M Counter Electrode Grinder : Single phase 100 V 100 W

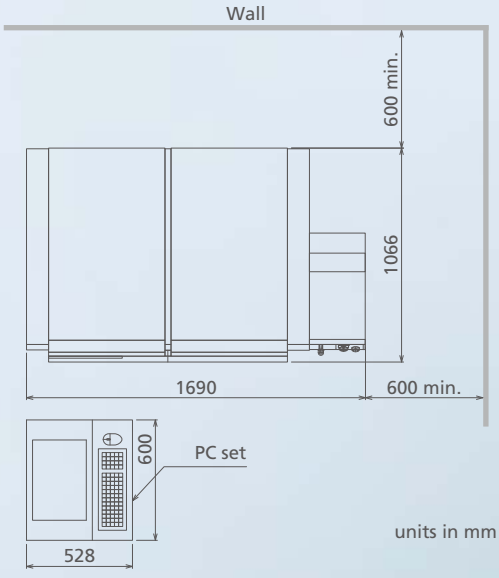
External Dimensions and Weight

PDA Instrument : W1690 × D1066 × H1142 mm

PC Set : W600 × D528 × H1380 mm

Weight : Approx. 600 kg

* For installation details, refer to the Pre-Installation Requirement.



Shimadzu Corporation

www.shimadzu.com/an/

First Edition: June 2010, Printed in Japan 3655-04902-10ANS