Operating MANUAL For XRF-2000 Series



Rev. 5.12

December 26, 2012

XRF-2000 Series Operating Manual

IMPORTANT – PLEASE READ THIS FIRST! COPYRIGHT©2011 MicroP Co., Ltd. ALL RIGHT RESERVED

PLEASE READ CAREFULLY THE OPERATION AND APPROPRIATE MAINTENANCE INSTRUCTIONS IN THIS MANUAL BEFORE ATTEMPTING TO OPERATE THE EQUIPMENT. NOTWITHSTANDING MICRO PIONEER'S LIMITED WARRANTY, MICRO PIONEER WILL NOT ASSUME ANY LIABILITY FOR INJURY, LOSS OR DAMAGE TO PERSONNEL, PROPERTY OR TO THE EQUIPMENT IF IT IS NOT CONNECTED OR OPERATED PROPERY.

SERVICE AND REPAIR OF THE SYSTEM SHOULD BE LIMITED TO QUALIFIED PERSONNEL ONLY. THE SYSTEM MUST BE DISCONNECTED FROM THE ELECTRICAL POWER SOURCE BEFORE SERVICING.

MICRO PIONEER RESERVES THE RIGHT TO MAKE CHANGES AND IMPROVEMENTS IF THE SYSTEM, AS WELL AS IN THE SPECIFICATIONS AND DESCRIPTIONS PROVIDED IN THIS MANUAL WITHOUT PRIOR NOTICE. FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

MicroP Co., Ltd.

RM# 704 Dae-Ryung Post Tower 6th 50-3 Kasan-Dong, Geumcheon-Gu, Seoul 153-715 Korea <u>www.micropioneer.com</u> TEL : +82-2-2083-8811 info@micropioneer.com

Table of Content

1. Introduction	
1.1 System Purpose	6
1.2 Principles of Operation	7
1.3 Typical Specification	8
2. System Operation	
2.1 Safety Considerations	10
2.2 Radiation Safety	11
2.3 Site Preparation	11
2.4 Software Installation	12
2.5 Drive Installation	13
2.5.1 Connect System to Computer	13
2.5.2 Install Drivers	14
2.5.3 To Increase System Speed	17
2.5 Running XRF-2000 Software	18
3. Main Window	
3.1 File Menu	19
3.1.1 Config Window	19
3.1.2 Administrator Login	20
3.1.3 Exit	21
3.2 Display	21
3.3 Cal	
3.4 Etc	23
3.5 MicroP Co., Ltd.	23
4. Main Toolbar	
4.1 System Configuration	25
4.2 Set Limit	25
4.3 SET Measuring Time	25
4.4 View Statistic Window	26
4.4.1 File menu	26
4.4.2 Print Menu	
4.4.3 Diff Block Menu	
4.4.4 Setup Menu	29
4.5 Spectrum Window	
4.5.1 Qualitative Analysis	
4.5.2 Editing and Manipulating Spectra	
4.6 Camera Display Window	
4.6.1 Sub Beam.	42
4.6.2 Find beam Center	43
4.7 Stage Control Window	46
4.8 Periodic Table	
4.9 2D&3D Measure Window.	47
4 9 1 2D(Step)	<u>4</u> 7

4.9.2 2D(Point)	47
4.9.3 3D(Scan)	48
4.9.4 3D(Point)	48
4.10 Random Stage.	49
4.11 Set Measuring Unit	49
4.12 Set Decimal Point	50
4.13 Cal File Select Window	50
4.14 Recalibration Window	51
4.15 New Calibration	52
4.15.1 Thickness Calibration.	52
4.15.2 Quantitative Calibration	56
4.15.3 Plating bath Calibration	62
4.16 System Adjustment Window	67
4.17 Focus Laser	68
4.18 Lamp	68
4.19 Set Y Stage Auto Move	68
4.20 Auto Cvcle Measurement	68
4.21 Auto Cycle Number	68
5. How To Measure	68
5.1 Loading Sample	68
5.2 Adjust Focus.	68
5.3 Select Cal File and Click Start Button	68
6. Maintenance	69
7. Troubleshooting	69
	00

Appendix

Α.	X-RAY FLUORESCENCE (XRF)	71
В.	New Calibration for Disk.	73
C.	New calibration for RoHS	80
D.	Calibration for CSFP	85

1. Introduction

1.1 System Purpose

XRF-2000 systems are designed to measure the thickness of multi coating elements or detect the elements in analyzed samples and determine their concentrations using X-Ray fluorescence (XRF).

The analysis performed by XRF-2000 series can by divided into three categories:

- Thickness measurement measure the thickness of multilayer coating
- Qualitative analysis Identification of the elements in a sample and inspection of the acquired spectra on a comparative basis.
- Quantitative analysis Quantitative determination of the concentrations of the elements in a sample. This is performed after carrying out calibration procedures, using a pre-analyzed set of standards and empirical models, or via the fundamental parameters method.

The system software (XRayV5) runs under Windows XP, Vista or higher.



XRF-2000 Series

1.2 Principles of Operation

XRF-2000 Series systems utilize the phenomenon that when a sample is irradiated with x-ray radiation, the sample's atoms are excited. As the atoms return to their stable state, they emit x-ray photons (X-ray Fluorescence – XRF).

Each element has its distinct characteristic emission lines. The energy of these lines are documented in tables and stored in the computer's memory. A given sample's elements are identified by comparing the lines in the acquired spectrum to the corresponding element lines listed in the system's database.

The intensity (magnitude) of the element's lines in the acquired spectrum is related to its concentration or thickness. Increasing the concentration or thickness of an element result is an increase in the intensity of the fluorescent radiation characteristic of that element. By using empirical or theoretical physical models, the system can provide precise qualitative and quantitative analysis or thickness measurement.

XRF-2000 Series systems employ a proportional counter or Si PIN diode detector to detect x-rays emitted from the sample. These detectors are capable of acquiring a spectrum containing many lines from many elements simultaneously. The counters or detectors convert the x-ray photons to proportional electric pulses. These signals are amplified and converted into a digital form by the Analog-to-Digital Converter (ADC). The data of the accumulated spectra are stored and displayed on the computer's monitor as a spectra histogram.

Besides characteristic lines, any observed spectrum also contains background signals, their characteristic dependent on many factors, especially excitation conditions. In order to reduce background and increase useful signal, X-ray high voltage and emission current can be varied, as well as utilizing changeable special filters. All these allow optimizing the spectrum of exciting X-ray beam for any given application.

ED-XRF analysis tools enjoy the following advantages:

- Broad concentration range from ppm (mg/Kg) levels up to 100%.
- Sensitivity to all the elements in the periodic table from Magnesium to Uranium.
- Fast response: Typical analysis time is usually under a few minutes.
- Simultaneous analysis of many elements.
- Non-destructive: The X-ray radiation does not leave any effects in the sample after analysis. Rare or precious samples are well as calibration standards can be tested an unlimited number of times without losing any of their authentic properties.
- Flexibility of sample form: The sample may be in solid, powder,

liquid or thin film form; or even be a few layers of elements plated on a thick base substrate. In most cases, samples are analyzed with minimal preparations.



1.3 TYPICAL SPECIFICATIONS

Input Power

115/220 VAC, 50/60Hz, 150W (maximum) Typically 220VAC 0.5A

Power Cable

The power cable will be supplied by the local MP representative to meet IEC 224 or IEC 245 standards.

The inner wire diameter should be at least 0.75mm.

Fuse

On the Main Power: 2A

Power On/Off Switch

Once the AC input cable is connected from the system to the wall, system power up and shut-down should be done using the On/Off switch on the front right side of the system.

Connect to PC

Only one connection by USB Cable



X-Ray System Specifications

Chamber				
Input Power	110/220 volts AC 50/60hz			
Data Port	USB			
Temperature Control	Automatic preamp and chamber temperature regulation			
Focusing	Precision laser assisted			
Sample Positioning	Laser-guided parts placement			
Safety Circuitry Automatic X-ray shut-off within 0. seconds, if chamber door opened during measurement				
Multi-C	hannel Analyzer			
Channels	1024, 2048, 4096, 8192 channels			
Pulse Processing	High speed using micro-processor			
Temperature Control	Automatically regulated			
X-	Ray Source			
X-Ray Tube	Long life, tungsten target, miniature spot size			
High Voltage	0-50kV, oil-cooled			
Tube Current	0-1.0 mA			
XRF Housing	Large oil-filled tank encloses both X-ray tube and high voltage			
Collimators				
Туре	Single fixed or multiple (automatic)			
Single Fixed	0.1, 0.2, 0.3, 0.4 0.1 x 0.3mm Other size (opion)			
Multiple Automatic (5 Total)	0.1, 0.2, 0.3, 0.4, 0.05 x 0.3mm			

D	etection System
Detector	Proportional counter Si PIN DIODE (150~260eV)
Filters	Motorized (Co, Ni Optional)
Primary Filters	Mo, Ta, Ti, Ni, Al (Optional) Total 7 Filters
	X-Y-Z Stages
Operating Type	Precision, high speed stepper motors with ramped acceleration and cushioned deceleration
Stage Positioning	Mouse or automatic controls "Point and Measure" 2-D and 3-D positioning
EZ Loading Stage	Automatic stage forward by opening/ closing door
С	amera System
Camera	Digital, CCD, color, high-resolution
Display Image	Monitor overlay video display
Reticle Image	Software generated target
X-Ray Beam	Collimator Size displayed by software
XRF Beam Alignment	X-ray beam and camera optics are auto aligned
Lighting	Long-life LED, adjustable
D	oual Focus
Normal	10-20mm fixed one point (Optional)
Dual	20-90mm fixed two point (Optional)

Calibrations			
Application	Single layer, multi-layer, alloy thickness and composition, plus solution analysis		
Correction Functions	- Density correction - Drift correction by reference sample		
Stat	istical Analysis		
Statistics	Mean, maximum, minimum, range, standard deviation		
Charts and Graphs	X-bar and range chart, histograms		
Re	port Printing		
Reports	Five (5) custom report formats		
Previewing	Instant previewing of reports		
Custom Heading	Company name and logo		
Parts Images	Sample picture can be printed on report		
Qualitati	ve Element Analysis		
Method	ROI and peak distance method		
Display	Color spectrum with element labeling		
Magnification	Magnifies/highlights desired items		
Sta	age Programs		
2-D	Regular distance parts and surface measurements		
3-D	Topographical mapping of plating thickness		
Random	Irregular distance parts measurement		

Chamber Model Specifications



Туре Н



Type L



Type PCB

Model Name	Туре Н	Type L	Type PCB (slotted)
Chamber Dimensions	610W x 670D x 600H	610W x 670D x 490H	610W x 670D x 490H
Inside Chamber Dimensions	550W x 550D x 100H	550W x 550D x 30H	Infinity x 30H
X-Y-Z Stage Travel	210W x 180D x 110H	210W x 190D x 30H	210W x 170D x 30H
Maximum Sample Weight	5Kg	3Kg	3Kg

These specifications are subject to change without notice due to product improvements.

2. System Operation

2.1 Safety Considerations

• Standard Procedures

All standard safety procedures for operating electrical machinery should apply to spectrometers of this series.

Each system is intended to be operated only as indicated in its Operation Manual.

Maintenance work inside the machine should be performed only by authorized personnel.

• Power Source

This product is intended to operate from a power source that does not supply more than 230 volts RMS (in 220 volt version) or 120 volts RMS (in 115 volt version) between either supply conductors or between supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

• Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of grounding conductor in the power cord is essential for safe operation.

• Danger arising from loss of Ground

Upon loss of the protective ground, all accessible conductive parts (including knobs and controls that may appear to be insulated) can render an electric shock.

• Use the proper power cord

Use only the power cord and connector specified for your product and valid in the country where the machine in installed. Make sure that both are in good condition and do not use extension cables.

• Use the proper fuse

To avoid fire hazard, use only a fuse of the correct type, voltage rating and current rating as specified.

2.2 Radiation Safety

XRF-2000 Series equipment is intrinsically safe from radiation hazards. Every machine is inspected prior to its delivery, ensuring that level of radiation anywhere around the sample chamber is not higher than the ambient radiation in the free environment. The instruments are equipped with safety magnetic switches to ensure that proper shielding is in place during x-ray operation, avoiding a possibility of exposure to radiation. Overriding safety features should not be done under any circumstances. These features have been installed for your safety.

Depending on the country, personnel operating X-ray instrumentation may have to be registered with the relevant health and radiation control authorities and may be required to wear dosimeters to monitor their exposure to radiation as well as to undergo annual medical examinations to safe guard their health. Local radiation control authorities may require that your instrument be registered with the relevant controlling bodies and that you carry out periodic radiation leak detection tests to ensure the ongoing safety in the utilization of the instrument.

You will need to check the relevant legislation and your compliance thereof with the correct controlling bodies in your country.

2.3 Site Preparation

• INSTALLATION SITE

The system site should be free of excessive mechanical vibrations and strong acoustical noise. Strong electrical fields such as those generated by arc welding instruments, induction furnaces, large electric power lines, etc., can interfere with signals from the X-ray Detector and decrease its resolution.

Please do not hesitate to consult the service agent if you suspect that such problems exist.

• PHYSICAL ENVIRONMENT

Keep the system and its vicinity clean and dust-free; circuit boards and components in the system and computer could fail due to an accumulation of conductive dust or from corrosion.

Avoid extreme temperatures or high humidity. The recommended operating temperature range is 20 - 25° C. Constant temperature assures the stability of system calibration.

2.4 Software Installation

Make sure your computer is correctly connected and then turn on the monitor and computer. XrayV5 is software of XRF-2000 series and updated periodically. You can download it from MicroP Co., Ltd. web site www.micropioneer.com.

The system has its own storage device as USB memory. When the system is connected to computer, USB memory will be your hard disk which is named XRF-2000.

XRayV5 includes many folders. Go to E:\XRayV5\Exe Folder and right click on XRayV5.exe and send to->desktop (Create shortcut).

rite Links	Name	Date modified	Type	Size
Documents ictures Ausic Aore » ers V Desktop XRF Public Computer Computer	ko-KR Adinterop.KIMDSHOW Axinterop.KIMUPDNLi Interop.KIMUPDNLib.dll KimDLLV2.dll KimDShow.ocx KimUpDn.ocx Microsoft.VisualBasic XRayV5.exe	10/19/2011 9:04 AM 10/4/2011 9:22 AM 10/4/2011 9:22 AM 10/4/2011 9:22 AM 10/4/2011 9:22 AM 10/15/2008 2:27 PM 8/31/2011 10:34 AM 2/2/2010 12:52 PM 8/19/2008 8:03 AM Open	File Folder Application Extens Application Extens Application Extens Application Extens ActiveX Control ActiveX Control Application Extens tion	13 KB 9 KB 13 KB 11 KB 208 KB 76 KB 40 KB 344 KB 3,663 KB
DVD Drive (D:)	8	Run as administrator		
CalFile CalFileBackup CSFP Driver ErrSpec Exe Manual NumRef PosData Spectrum		Cut Copy Create Shortcut Delete Rename Properties	Docur Mail F XRF-2	nents lecipient Jrive (D:) 000 (E:)
System System Wetwork Control Panel Recycle Bin XRayVS.exe Date modified: 11	./1/2011 2:21 PM			
Application Size: 3. Date created: 10	57 MB 0/22/2011 1:58 PM			



USB Hub inside System

2.5 Drive Installation

- 2.5.1 Connect System to Computer
 - System Power On and connect system to computer through the USB cable. Then "Found New Hardware window will be displayed as below.



 Cancel all windows for driver installation and make sure if your system disk drive recognized as follow.



 If you see system disk drive as above, go next.(Drive name might be different depends on computer configuration).

2.5.2 Install Drivers

- ♦ Go to Control Panel → System → Device Manager - IC 🗙 🚇 장치 관리자 파일(F) 동작(A) 보기(V) 도움말(H) ← → 📧 🕾 🎒 😫 🖻 🖪 🗮 🧏 🛃 🖃 💻 JONGRO-XRF 🖻 🚱 기타 장치 USB Device - EZ Cap, Video Capture Drive
 USB Serial Converter and Serial Port 🛨 💵 네트워크 어댑터 🖻 🥪 티스크 드라이브 - See Hitachi HDS721016CLA382 🛭 🥪 SanDisk Cruzer Blade USB Device XRF-2000 🖻 👰 디스플레이 어댑터 System Drive □ ○ 마우스 및 기타 포인팅 장치
 □ ○ 모니터
 □ ○ 범용 직렬 버스 컨트롤러
 □ ○ 사운드, 비디오 및 게임 컨트롤러 🖻 🖳 시스템 장치 전 조소 볼륨
 전 3 검퓨터 🖻 🍉 키보드 🛓 🞐 포트 (COM 및 LPT) 🗉 🌨 프로세서 🗄 🥝 DVD/CD-ROM 드라이브 🖻 🗃 IDE ATA/ATAPI 컨트롤러
 - ✓ There are two uninstalled drivers, USB device which is EZ Cap (Video Capture Card) and XRF-2000 which are USB serial converter and USB serial port.
 - ✓ Disk drivers are automatically installed and nothing to do.
- Right Click on XRF-2000 and click "Update drive software".
- Click Browse Icon and select E:\XRayV5\Driver\Serial directory as below;

browse for anversor ware on you	r computer		
Search for driver software in this location:			
E:\XRayV5\Driver\Serial	-	Browse	
Let me pick from a list of devi This list will show installed driver softw software in the same category as the d	ce drivers on my co are compatible with the e evice.	omputer device, and all driver	

• Click Next will install the driver for USB serial converter.

하드웨어 업테	이트 마법사	
마법사가 소	프트웨어를 설치하는 동안 기다려 주십시오	
¢	USB Serial Converter	
	FTLang.dll C:₩WINDOWS₩system32(으)星	
	< 뒤로(<u>B</u>) 다음(<u>N</u>) > 취소	

 After installing the driver you can see the USB Serial Converter in Device Manager as bellow.

🚔 Device Manager	
File Action View Help	
Ports (COM & LPT) USB Serial Port (COM5) Processors Sound, video and game controllers Controllers Controllers	•
System devices Universal Serial Bus controllers Generic USB Hub Generic USB Hub Intel(R) ICH9 Family USB Universal Host Controller - 2934	
Intel(R) ICH9 Family USB Universal Host Controller - 2935 USB Root Hub USB Root Hub USB Root Hub USB Root Hub USB Serial Converter	

- Right Click again on XRF-2000 and "Update drive software".
- Click Browse Icon and select E:\XRayV5\Driver\Serial directory.
- Click Next will install the driver for USB Serial Port.

 Finally you can see the USB Serial Converter and USB Serial Port in Device Manager as below;



- Right Click on USB Device and "Update drive software".
- Click Browse Icon and select E:\XRayV5\Driver\EzCap directory.
- Click Next will install the driver for EzCap capture card and you will see the USB2861 Device on device manager as below.



2.5.3 To Increase System Speed

- Quit the XRayV5 program.
- Go to Control panel -> System -> Device Manager -> Ports (COM & LTP)
 -> USB Serial Port -> Properties -> Port Settings -> Advanced and change Latency time to 2 as follows.

Advanced Settings for COM6			? 🔀
COM Port Number: COM6		ſ	ок
USB Transfer Sizes			Cancel
Select lower settings to correct performance problems at low Select higher settings for faster performance.	v baud rates.		Defaults
Receive (Bytes):			
Transmit (Bytes):			
BM Options	Miscellaneous Options		
Select lower settings to correct response problems.	Serial Enumerator		
I steppy Timer (mean):	Serial Printer		
	Cancel If Power Off		
Timeouts	Event On Surprise Removal		
	Set RTS On Close		
Minimum Read Timeout (msec):	Disable Modem Ctrl At Startup		
Minimum Write Timeout (msec):			

- Click OK and return to normal operation mode.
- Close Device manager.
- Execute XRayV5 program again.

2.5 Running XRF-2000 software

- ① Turn on the XRF-2000 Series Machine.
- ② Turn on the computer (if not already done) and click the XrayV5 icon on the desk top to active XrayV5.
- ③ Enter Password "t" and click on the opening message.
- ④ The main XRayV5 screen appears.



3. Main Window

🚼 Coating thickness	measurin	ng (5, 12, 1122, 4) X					
File Display Cal	Etc, Te	est MicroP Co,	, Ltd,					
Measuring Time	Elm	CPS	μm					
10 Sec	Au	0.00	0.00					
Collimator 3.000 mm	Ni	0.00	0.00					
Start								
26 %Au/Ni//Cu Multi 50k	(V/204uA,	5,Ni 24,0µm,						

Indicate Measuring Time, Collimator Size, Start and Stop Button, CPS Information, Result of Thickness or Concentration and Measuring Mode. Start Button toggles start and stop to measure.

3.1 File Menu

🕂 Coating thickness measu	uring (5, 12, 1122, 4)	×
File Display Cal Etc. Config	Test MicroP Co., L	_td,
Administrator Logout	CPS	μM
- Exit	0.00	0.00
3.000 mm	0.00	0.00
Start		
26 %Au/Ni//Cu Multi 50kV/204u	JA, 5,Ni 24,0μm,	

3.1.1 Config window

🗐 Configuration 📃 🗙	🚽 Configuration 📃 🔀	🗐 Configuration	x
1 2 Admin Set Focus Laser	1 2 Admin Set Z down when door open	1 2 Admin Set Toolbar set Image: Limit Image: Meas. Time Image: Disp. Unit Image: Disp. Resol. Image: Limit Image: Comparison of the temperature of temperatu	
Change Password User Administrator	Stage control direction Image: Dir. Stage Dir. Focus Measuring end sound Enable Use Buzzer(Hz) Sound wav	Program Mode C Thickness © Quantitative	

Menu 1

- Focus Laser: Control brightness of laser on Camera Window.
- Excel (Open Office is available in public)
 - Send Data: ON/OFF data transfer to Excel. Excel file must be opened prior to data transfer.
 - Send Date & Time: ON/OFF date and time to Excel.
 - Send CPS: ON/OFF CPS to Excel

• Change Password

Change the operator and administrator password.

Administrator password can be changed when administrator is logged in.

Menu2

- Z down when door open: Enable Z axis down to specified distance when door is opened.
- Auto focus (Only flat Sample): Enable automatic focus prior to start measurement.
- Stage control direction: Dir. Stage moves stage same direction with stage control direction. Dir. Focus moves stage opposite direction with stage control direction.
- Measuring end sound: Specify music file (wav format) or internal buzzer to hear when measuring is finished.

Admin Set

- Tool Bar Set: Set On/Off listed sub menu in Tool Bar. Default is checked all.
- Program Mode: Define system as Thickness Gauge or Elemental Analyzer, the system which has Dual Detector must be selected as Quantitative.
- 3.1.2 Administrator Login
 - Initial password is "t".
 - ✓ Enable specific menu in administrator mode



• Camera display window

After administrator login, enabled menu on Camera Window shows in right side.



Re Calibration, New Calibration, Measuring correction, Density correction menus are enabled when administrator Login.

Select Cal File :
 Select calibration file
 Select calibration file
 Select calibration file

Delete Cal File and comment on Cal File are enabled when administrator is logged in.

3.1.3 Exit

Quit the program

3.2 Display



Toggle window on and off. Description of each window is described in Chapter 4.





Description of function is described in Chapter 4 except following.

	Measuring	Correction :	Make	user	correction
--	-----------	--------------	------	------	------------

	Gain	Offset
SnPb	1	0
Sn%	1	0
Ni	1	0
iain =	Target Hi -	· Target Lo
	Measured	Hi - Measured

Gain=1 Offset=0 is default value which means measuring correction is not effected to result.

3.4 Etc



Description of function is described in Chapter 4 except the following.

 Auto cycle interval: Input Auto cycle interval time. The interval time is measuring time plus rest time.

uto cycle interval time	X
Input Auto cycle interval time	ОК
	Cancel
5α	

3.5 MicroP Co., Ltd.

Display Micro Pioneer company information, Software version and System Serial No.



De Tool	
	<i>ᢍ</i> 🛄 🕀 🏝 🔛 ⊥⊥ μm + 123 📜 🕑 ℕ 🚍 🔧 汊 Y Ac A¹ċ
2	Laser Focus, Send to Excel, Change Password, Program Mode
Lim HH	Set control limit of Result
	Set measuring time
	Display statistic window
	Display Spectrum windows
	Display Camera window
$\stackrel{\texttt{l}}{\longleftrightarrow}$	Display Stage control window
۲	Display Periodic Table window
	Display 2D & 3D measuring window
<u> </u>	Display Random stage window
μm	Set measuring unit
12.3	Set Display decimal point
	Select calibration file
B	Re-Calibration of Cal file
N	New Calibration of Cal File
\leftrightarrow	Display System adjust window
×	ON/OFF Focus Laser
-X Q	ON/OFF illumination lamp on camera window
‡Y	ON/OFF Y-Stage Push-Pull function. ON: when Door opened, Stage move to forward.
Ać	ON/OFF Auto-Cycle function
A ¹ .:	Set number of Auto-Cycle count

4. Main Toolbar



4.2 Him Set Limit

Auto set limit		Limit Value Open	Set
[] (Jse Ng/Go color	Save	Cancel
	Lower (Under bad)	Upper (Over bad)	Mode
Cr	0.0	1934.0	None
Br	0.0	2093.2	None
Cd	0.0	620.1	None
Hg	0.0	2122.3	None
Pb	0.0	2379.2	None

- ✓ Lower : Lower limit value for Low Mode
- ✓ Upper : Upper limit value for Up Mode
- ✓ Mode
 - Low : Measured data is bigger than 'Lower value' means good
 - UP : Measured data is lower than 'Upper value' means good
 - LowUp: Measured data is between 'Lower value' and 'Upper Value' means good.
- ✓ Auto Set Limit: Set the limit value automatically from measured data.
- ✓ Use Ng/Go Color: Display the data result as a color, Green means good, Red means no good.
- ✓ Open/Save: Open or Save the limit value file.
- ✓ Set: Apply limit value.
- ✓ Cancel: Cancel limit value.

4.3 Set Measuring Time

Sets the measuring time (the sample is exposed to X-rays). The figure below defines Clock Time vs. Measuring Time (also called "Live-time") and Dead Time.

	Measuring Time	Dead Time	
	Clock Time		
◀			≁

The Clock Time is corrected for the Dead Time, always meaning:

Clock Time≥ Preset Time



Enter measuring time and click OK or press enter key.

4.4 Wiew Statistic Window

File	e Pr	int	Diff	Block	Se	tup			
Rep	o Vi	ew	Use	r Viev		Opt,	Opt	Del	Title
No	Crp	pm	Br	ppm	Сс	l ppm	Hg	ppm	Pb ppm
1	977	7.9	10	044.0	3	15,0	106	7,5	1206, 5
2	398	8,5	5	36, 9	1	06, 6	20	5,8	396, 2
З	0,	0	1	0,0		1.1	1.	5	0,0
4									
5				1					
6									
7									
8									
9				1					
10									
М	ax	977	<u>, 9</u>	1044.0)	315,0	10	067,5	1206,5
M	in	0,	0	0,0		1,1		1.5	0,0
Rar	nge	977	.9	1044.0	2	313,9	10	066, 0	1206,5
Me	an	458	8,8	527.0		140,9	4	24,9	534,2
Std.	Dev.	491	.7	522, 1		159,7	5	65,8	615,0
C\	1%	107	.2	99, 1		113,4	1	33, 1	115,1

Statistic Window displays thickness or concentration of samples and statistical information. Also provide a function of preview, print, user defined print form, adding comment and open/save file.

4.4.1 File Menu

File	Pri	int Di	ff Block	Setup		
Cop		y n	Ctrl+C	N.	Spt Del	Title
1	Save	9		pm	Hg ppm	Pb ppm
	Exit	100000	1.1	0	1067,5	1206,5
	Save	e Data Pr	ocessing		205,8	396, 2
3	0,0	0	0.0	1.1	1.5	0,0
4						
5		-			-	-
6						
7						
8		1				
9						
10						
Ma	×	977,9	1044.0	315,0	1067.5	1206,5
Mir	n i	0,0	0,0	1.1	1.5	0,0
Rang	je	977,9	1044.0	313,9	1066,0	1206,5
Mea	In	458,8	527.0	140.9	424,9	534,2
Std, D	ev,	491,7	522,1	159,7	565,8	615,0
CV2	%	107,2	99,1	113,4	133,1	115,1

- Copy: Copy data to clip board as a text and to paste to notepad etc.
- Open: Open saved data file.
- Save: Save data file as default (*.sdt), old version(*.n001) and text(*.txt) format.
- Save Data Processing: Save data for bar code reader etc.

4.4.2 Print Menu

- Select a different type of print form such as UPA type, CMI type etc.
- Each menu has a preview mode, direct print mode and print to image mode.
- Set option report menu to fix the print form as one of the various.

File	Pr	int Dif	f Block S	etup			
-		User 🕨	- F		13		
Repo		Report		- 1 -	Opt Del	Title	
No	6	X/R-Ba	X/R-Bar	Hg ppm	Pb ppm		
1	-	UPA CMI			1067,5	1206,5	
2					205,8	396.2	
3		Seiko		•	1,5	0.0	
4		ROHS		•			
5		Quant	itative	•			
6	-	Set op	tion report	• †			
7	_						
8							
9							
10							
Ma	<	977,9	1044,0	315,0	1067,5	1206,5	
Mir	Ú.	0,0	0,0	1,1	1.5	0,0	
Rang	le	977,9	1044.0	313,9	1066,0	1206,5	
Mea	n	458,8	527,0	140,9	424,9	534,2	
Std, D	ev,	491.7	522, 1	159,7	565,8	615,0	
CV9	6	107.2	99.1	113.4	133.1	115.1	

Right Click to delete line by line or to copy whole data to move to Excel. Click Title to edit Customer name, part No., etc.

🖳 Sta	atistic				×
File	Print D	oiff Block S	etup		
Repo	View U	ser View	Øpt, Opt	Del Title	
No	Au wt%	Ag wt%	Cu wt%	Zn wt%	-
5	91,6	8,2	0,2	0,0	
6	85, 1	13,8	1,0	0, 1	
7	80, 3	17.8	10	ρ, ο	
8	75,2)el	1,0	=
9	70, 3		ору	1.1	
10	64,9		iew Spectrum	1,5	
11	58, 3	21,2	20,3	0, 1	
12	58,7	27,1	14,1	0, 1	
13	58,6	24,8	15,2	1,5	
14	59,6	4,0	27,2	9,2	+

4.4.3 Diff Block Menu

S	tatisti	с						-		0	-S	3
File	e P	rint	Dif	f Blog	:k	Setup)					
-0	2 🗛			Sav	e				×	<	1	1
Repo	o Vie	w		Cle	ar			v	De	à	Co	nf
No	Crp	pm	1	Pre	view			m	РЬ	pp	m	-
1	0,	0		Prir	nt				(D, O		
2		0		Print to image						0,0		
3		0	0	.0	0), ()	0	.0), O		
4	57,	0	0	.0	C), O	0	0,0		0,0		
5	0,	0	0	.0	C), O	0	.0	(D, O		H
6	0.	0	0	.0	C), O	0	.0	(D, O		
7	0,	0	0	0,0), O	0	.0	(D, O		
8	0.	0	116	69,0 3		306, 9		35,6	(D, O		
9	848	1,3	53	6,9	246,5		27	71,4		399, 3		
10	123	1,3	0	.9	C), O		0,0		0,0		-
М	ах	840	3, 3	116	9, 0	306,	9	1235,6		399		3
M	lin	0.	0	0,	0	0,0)	0,0		1	D, O	
Rar	nge	848	3, 3	116	9,0	306,	9	1235	5,6 3		99, 3	3
Me	ean	102	2,9	170), 7	55,	3	150,	7	3	9,9	
Std,	Dev,	26	5, 0	389	9,2	117,	5	390,	6	13	26,3	3
C1	1%	25	7.7	228	8,0	212,	4	259,	2	3	16,2	2

- This Menu allows printing different applications' results in same format on same paper.
- Select Cal file and analyze sample and drag result and Save, go another Cal file and analyze sample and drag result and Save.
- The results from different application are printed in same format.

🖳 Print pr	eview								
⊜ , ∕ , •		• •	Close						Page 1 🌲
ſ									
		Custo	omer:						
		Mode	81 -						
		RoH	B_PE		Tues	day, June 30.	2009 11:59:42	AM	
		1	Cr ppm = 0.0	Br ppm = 0.0) Cd	ppm = 0.0	Hg ppm = 0.0	Pb ppm = 0.0	
		2	Cr ppm = 0.0	Br ppm = 0.0) Cd	ppm = 0.0	Hg ppm = 0.0	Pb ppm = 0.0	
		3	Cr ppm = 0.0	Br ppm = 0.0) Cd	ppm = 0.0	Hg ppm = 0.0	Pb ppm = 0.0	
		SnPt	o/Ni//Cu		Thu	rsday, July 09	9,2009 6:09:38	PM	
		1	SnPb µm = 0.2	579 Sn% =	100.0	Pb% = 0.0	Ni µm = 0.537	1	
		2	SnPb µm = 0.2	506 Sn% =	100.0	Pb% = 0.0	Ni µm = 0.479	0	
		3	SnPb µm = 0.2	355 Sn% =	100.0	Pb% = 0.0	Ni µm = 0.509	5	
		4	SnPb µm = 0.2	906 Sn% =	100.0	Pb% = 0.0	Ni µm = 0.516	8	
		5	SnPb µm = 0.2	385 Sn% =	100.0	Pb% = 0.0	Ni µm = 0.509	9	

4.4.4 Setup Menu

🖳 St	tatistic			
File	e Print	Diff Block	Setup	
		2	Co	onfiguration
Rep	o View	User Viev	Se	t user defined print file
No	Cr ppm	Br ppm	Ed	lit user defined print file
1	977,9	1044,0	Di	splay statistic result
2	398,5	536,9	Di	splay comment
3	0,0	0,0	Ac	ljust window width
4	4,7	708,4	Se	t number of data row
5	4, 1	34,1	Se	tup Save Data Processing
6			Di	splay ROHS save window
7			-	
8				
9				
10				-

4.4.4.1 Configuration

Common Title X/R-bar Bloc	k UP#	A Seiko I	CI
X/R Bar	Print	item	-
Spec line color	En	Elem	-
Cont line color		Cr ppm	
Mean line color		Br ppm	
📝 Print Hor grid		Cd ppm	-
👿 Print Vert grid		Hg ppm	
📝 Print Maker		Pb ppm	-
Histogram	Std F	ont	- W - 2
Color		굴림	
Number 3	C	hanna Std Fon	t
📝 Auto Number(Root(n))		iange ola i on	`
🔲 Clear before external start			
📄 Data overwrite			
Copy with CPS			

All option for print form is able to define in configuration menu, such as customer name, company logo and others.

4.4.4.2 Edit User Defined Print File

1) Open the Statistic Window

St	tatistic		
File	e Print	Diff Block	Setup 1
-	2 🔊		Configuration
Rep	o View	User Viev	3 Set user defined print file
No	Cr ppm	Br ppm	2 Edit user defined print file
1	977,9	1044,0	Display statistic result
2	398, 5	536,9	Display comment
3	0,0	0,0	Adjust window width
4	4,7	708,4	Set number of data row
5	4, 1	34,1	Setup Save Data Processing
6			Display ROHS save window
7			
8			
9			
10			· · · · · · · · · · · · · · · · · · ·

The sequence of creating the user defined print form is Setup -> Edit user defined print file -> Save edited user defined print file -> Set user defined print file -> View and repeat until the completion.

2) Edit user defined print file

Go to setup -> Edit user defined print file.

trings	Save Cut Del E	<mark>}</mark> x.		File	Print	Diff Bloc	k Setu	P Configurati	ion
Item X Y Strings	Strings Micro Pioneer			No C	rew	Broom	C	Edit user de	fined print file
	Print position(mm)		_		1 ppm	Vd3 d	-		inted print me
	Left Top X	Hight bottom X		2 4	/9.7	4JJ.J 602.0		Display stat	istic result
	Left Top Y 20	Flight Bottom Y	1	2 9	78.6	507.7		Display con	nment
	Line width 0.	1 Draw color		4 3	76.1	492.4		Adjust wind	dow width
	Print real size	Hor Align Lower	•	5	173	492.0	99.6	205.0	282.6
	Print camera scale	Vert Align Left		6	47.5	452.0	55.0	200.0	302.0
	lmage			7					
				8	2			2	
				q	1				
	-			10	2	2		8 8	
	Font		_			7 507	7 107	1 2200	200.7
	Set Font(Doub	le click here!)		Max	449.	./ 50/	/ 10/.	1 226.6	398.7
				Min	3/6.	492.0	00.0	9 180.0	309.0
				Range	/3.1	b 15.7	23.2	46.6	39.2
				Mean	409.	2 498.0	96.4	201.4	3/9.2
				Std. Dev	. 36.0	b 7.3	9.0	16.9	14.2
				CV%	8.9	1.5	9.3	8.4	3.7

Then blank setup table will appear as above. Click Ex. Icon to open the standard print form.

Draw box		•	Add Modi Or	pen S	ave Cut Del	Ex.			
ltem	Х	Y	Strings	*	Strings	Se	et Example of use	er defin	ed prin
Draw box	145	35			Print position (mm))			
Strings	167.5	40	Micro Pioneer		Left Top X	145	Right bottom X		190
Customer	15	20			Left Top Y	35	Right Bottom Y		45
Draw line	15	32		н	Line width	1	Draw color		
Model	15	42			Print real size	e	Hor Align	ower	
Draw box	10	47			Print camera	scale	Vert Align	eft	v
Data	15	60			Impag				
Draw box	15	60			imaye				
Application	15	160							
Block Size	15	165							
Data No	15	170			Font				
Max	15	175			Set Font(Double	click here	!)		
Min	15	180							
Range	15	185		1					

The relation between setup table and hard copy of the user defined print file is as follows.



XRF-2000 Series Operating Manual



The print position of X and Y means as follows.

ltem	Х	Y	Strings	Strings	
Draw box	145	35		Print position(mm)	Model : XRF-2000 Series R
Strings	167.5	40	Micro Pioneer	Left Top X 15 Right t	m X 130
Customer	15	20		Left Top Y 60 Right I	um Y 150 Left Top X
Draw line	15	32	E	Line width 0.1 Draw	r No Crppm Brppm Cd ppm Hg ppm Pb ppm 1 394.1 493.9 107.1 226.6 398.7
Model	15	42		Print real size Hor A	Lower - 3 378.6 507.7 83.9 19.4 374.7
Draw box	10	47		Print camera scale Vert A	Left - 5 447.3 492.0 99.6 205.0 382.6
)ata	15	60		Imana	
Draw box				mage	Left Top Y
Application	15	160			
Block Size	15	165			
)ata No	15	170		Font	Right Bottom Y
Max	15	175		Set Font(Double click here!)	
Min	15	180			
Range	15	185	-		Color Right Bottom X

3) Add/Delete Item

🕂 User defined pr	int se	tup								2
Draw box 1 Draw box Data	-	Add	Modi Op	en Sa	ave Cut Del	Ex.				
ata No		5	IS		5					_
lock Size		-	D.	-	Print position(mm)	15	Dista Lana	- v T	120	
Aax		Mich	o Pioneer	-		10		m 🔨 🚽	130	
/lin		L		_	Left Top Y	60	Right Botto	mΥ	150	
ange Jean				III	Line width	0.1	Draw color			
td. Dev.					Print real size	2	Hor Align	Lower		Ŧ
V%					Print camera s	cale	Vert Alian	Left		Ŧ
p					1	12,7558	a sich aldri	22007		
pplication					Image					
urrent date										
urrent time										
amera										
-Bar		-		-	F					
-Bar		<u> </u>		-	Font					
listogram					Set Font(Double c	lick here	!)			
o limit										
li limit	1.000			2						
leasuring time		-								
Sustomer										
lodel										
ublisher										
lotes										
.ot. No.	-	J.								

ADD -Select item to add, specify print position and click Add Icon then save to user defined print file(*.UDP).

🖳 User defi	ned pri	nt set	tup	- 17		/			×
Customer		•	Add Modi	3 5	ave Cut 2	Ex.	(
ltem	Х	Y	Strings	-	Strings				
Draw box	145	35	- 20 - 20		Print position (mm)			
Strings	167.5	40	Micro Pionee	er	Left Top X	15	Right bottom	Х [0
Customer	15	20	1		Left Top Y	20	Right Bottom	Y	0
Draw line	15	32		E	Line width	0.1	Draw color		
Model	15	42			Print real siz	е	Hor Align	Lower	-
Draw box	10	47	1		Print camera	a scale	Vert Align	Left	+
Data	15	60	-		lass in				
Draw box	15	60			inage				
Application	15	160							
Block Size	15	165							
Data No	15	170	20		Font				
Max	15	175			Set Fon	t(Dou	ble click	her	el)
Min	15	180							/
Range	15	185		+					

Delete – Select item to delete and click Cut Icon then save to user defined print file(*.UDP).

4) Edit Item

Draw box		•		Ļ	- d X	5%	0			
		1755	Add Modi	n Si	ave (4	Ex.				
Item	X	Y	Strings	1	Strings					
Draw box	145	35	1		Print position(mm)					
Strings	167.5	40			Left Top X	145	Right bottom	x	190	
Customer	15	20	3		Left Top Y	35	Right Bottom	Y	45	
Draw line	15	32		=	Line width	1	Draw color			
Model	15	42			Print real size	2	Hor Align	Lower	8	-
Draw box	10	47			Print camera s	cale	Vert Align	Left		+
Data	15	60			lane and					
Draw box	15	60			mage					
Application	15	160								
Block Size	15	165								
Data No	15	170			Font					
Max	15	175			Set Font(Double c	lick here	D.			
Min	15	180								
Range	15	185		-						

Edit – Select item to edit and change the print option such as position, color, Font and line width etc. and click Modi Icon then save to user defined print file(*.UDP).

5) Sample of User Print Form



4.5 Spectrum window

4.5.1 Qualitative Analysis

The objective of qualitative analysis is to identify the elemental component of unknown substances. The first step in qualitative analysis is spectra acquisition. Following spectra acquisition, the spectra must be manipulated and studied to best determine additional spectra acquisition and/or the qualitative answer desired. This covers guidelines for qualitative analysis including various spectral manipulations.

• Setting acquisition parameters

(High Voltage and Tube Current setting in CAL File)

Since the purpose of qualitative analysis is to identify the components in a sample, acquisition parameters should be selected to optimize the identification CAL File. This is done by maximizing the spectral range covered by the excitation-detection system as well as obtaining sufficient sensitivity to identify even trace amounts of the elements present in sample. This is accomplished by optimizing the X-Ray levels. Total CPS on Spectrum window is a good indication of this optimized level. Voltage (KV) and current (uA) settings, combined, should allow for Dead Time 30% in PIN Diode System, 5% in Proportional Counter system.

• Guidelines to excitation parameter efficiencies

HV	47 kV	
TC	600 uA	•
Filter		Ŷ
Primary	Mo 150,0µm	+
Focus		
MCA	4096	Ŧ
Time	LiveTime	
Gain	3712	*
OffSet	1502	*
Colimato	r	
Hom	e 145	
3,000		-
3,000 RTD O Use Si Deadtime Target	FF 👿 Remove B.G Detector e Adjust TC to	•

Place cursor on Main window and click the Main window then press Alt+Ctrl+Shif simultaneously and hold these keys and type "pioneer" and Press Enter key. Then service menu will appear in spectrum window. Click Service menu on the Spectrum window.

On the service menu try to get a good spectrum regarding application by changing all the parameters such as HV, TC, Primary Filter and collimator etc.

Clicking adjusting TC to Dead time button will optimize tube current for 30% of dead time(PIN Diode), 5%(Proportional Counter).

For more specific excitation conditions, the use of filters to modify the exciting radiation is recommended. Filters modify the exciting radiation and may selectively enhance the excitation of certain analytes within the sample.
4.5.2 Editing and Manipulating Spectra

Automatic identification of peaks can be performed after spectra have been acquired. Click the Setup pull-down menu. Click Display element symbol in the Spectrum Window.



Then the symbols of the elements will be displayed as follows;



The overwrapped spectrum is acquired by proportional counter and main spectrum is acquired by Si PIN detector for 18K Gold alloy. These spectra show the different resolution for the same sample since resolution of counter is around 1,200eV and PIN detector is 149eV. If the peak is not identified automatically move cursor to center of the spectrum then the bottom of the

window display the possible element, channel, KeV and Data(CPS) as shown in above. The Green peak on right side is peak for Silver K-a(22.16KeV) but it is not identified automatically because the center of the sliver K-a moved to the left (called peak shift) as 21.96KeV. Therefore the right two peaks should be determined as K-a and K-b of the Silver by operator because there are no other possible elements regarding its energy of the X-Ray. Using the proportional counter, it will be looked like as follows;



Because of wide resolution of the proportional counter, Cu and Zinc are overwrapped each other. Sometimes this is very confused to identify the peak. So if there is a peak in certain ROI (Region of Interest) it is possible to exist overwrapped peak by neighborhood elements. View periodic table menu on tool bar provides useful function to identify the spectra. Click View periodic table menu on tool bar.



Clicking specific element shows its information such as Atomic number, Energy Value etc. and two vertical lines (blue lines) which is ROI low and ROI High are placed on the Spectrum window. Below is example of clicking Au.



Drag to specific area can extend display area for details of the spectra.

XRF-2000 Series Operating Manual





Click Right button shows menus to initialize, expend/reduce the vertical scale and reset to original spectrum.





- ✓ Open/Save: Save sample image as bmp or jpg format.
- ✓ Copy: Copy sample image to clipboard.
- ✓ Start view: Start capturing sample image.
- ✓ Comment: Enter comment text to print.
- \checkmark Print: Print sample image.
- ✓ Move by click
 - Double click where you want to move.
 - Left click to move XY axis, Right click for Z focus.
- ✓ Scale color: change scale color.
- ✓ Display scale: ON/OFF scale line.
- ✓ Copy with Scale: Copy to sample with scale to clipboard.
- ✓ Beam color: Modify Beam display color.
- ✓ Display beam : ON/OFF beam display
- ✓ Display scale into beam: ON/Off scale inside collimator circle.
- ✓ Adjust scale position: Adjust center of scale line manually.
- ✓ Find beam center: Automatically find the beam position.
- ✓ Scale Unit: Change scale unit in mm or mils.
- ✓ Capture: Select image source device (Capture Card).



4.6.1 Sub Beam: Generate multi indicator

 To change the camera window size, hold and drag right side or corner of the camera window.



4.6.2 Find Beam Center

To find beam center, use below position reference.



Click Find beam center on Camera Window.



Place center of camera to Cu Part of the position reference and click Start.



Place center of camera to Sn Part of the position reference and click Start.



Place center of camera to Cu Part of the position reference again and click Start.



Place center of camera to border line between Cu and Sn of the position reference and click Start.



When system finish to find the center of beam, make sure the vertical line coincide with border line between Cu and Sn. If does not, Go setup -> Adjust scale position.



Adjust vertical line to border line between Cu and Sn. Click SET.



Perform same way for horizontal line by loading position reference as follows.



Click END to save and exit.

4.7 $\stackrel{\text{1}}{\longleftrightarrow}$ Stage Control Window

Moving speed will be changed by the mouse operation. Left button is slow speed control. The speed will be changed by the clicked position. The inner position is slow speed and outer position is fast speed. Right button is fast speed control by using acceleration and deceleration method.





Periodic Table													23				
1 H	At, num, : 89 Symbol : Ac Name : Actinium At weight : 227 Despite : 10.07													2 He			
3	4	4 Ka(KeV): 90,88691 Density: 10,07 5 6 7 8 9 Be 12,65246 (314) B C N O F 7										10					
Li	Be											Ne					
11	12	2 13 14 15 16 17									18						
Na	Mg	g Al Si P S Cl									Ar						
19	20	21	22	23	¥24	25	¥26	27	¥28	¥29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
37	38	39	40	41	42	43	44	45	46	¥47	48	49	^{▼50}	51	52	53	54
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te		Xe
55	56	71 72 73 74 75 76 77 78 ^v 79 80 81 ^v 82 83 8							84	85	86						
Cs	Ba	Lu Hf Ta W Re Os Ir Pt Au Hg TI Pb Bi P							Po	At	Rn						
87 Fr	88 Ra																
		57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb		
		89 90 91 92 93 94 95 96 97 98 99 100 Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Ac (89)									•						

4.9 2D&3D Measure Window

4.9.1 2D(Step)



4.9.2 2D(Point)

🛄 2D & 3	D Meaure		23	Move Sample to start position and
2D(Step)	2D(Point)	3D(Scan)	3D(Point)	Click Neg. Start Bullon.
Re	eg. Start) <mark>x</mark>	Y	Move Sample to end position and Click Reg. Stop Button
Re	eg. Stop]		Enter Number of Analysis
Curr	ent Position Meas. point]	Click Start measuring.
Curr	ent Number			
	Start r	neasurir	ng	
Retu	rn start posit	ion after me	asuring	

Moving distance = (Start - Stop) / (Meas. point - 1)

4.9.3 3D (Scan)





4.9.4 3D (Point)



- ✓ Place camera position and cursor to left top and click Reg. Axis Button.
- ✓ Place camera position and cursor to right top and click Reg. Axis Button.
- ✓ Place camera position and cursor to right bottom and click Reg. Axis Button.
- ✓ Enter No. of point for X, Y. Then moving distance for X and Y are calculated by system.
- ✓ Click Start button.

4.10 Random Stage

Random Stage(Silver)									
Setup									
). 🔚 🕂 🗸 🚔 🗙									
No	Х	Y	Z						
1	87.51	142.71	9.990						
2	78.27	142.34	9.990						
3	69.20	142.34	9.990						
4	59.00	142.34	9.990						
5	51.72	142.34	9.990						
6	39.44	142.34	9.990						
7	30.80	142.34	10.315						
8	21.58	142.34	10.315						
9	10.59	142.34	10.315						
10	3.44	142.34	10.315						

✓ Open/Save : Open/Save position data file.

 $\checkmark~$ Set: Register the axis data. Space bar also works.

✓ Run: Start the measuring.

✓ Del: Clear all axis data.

✓ Ref: with saved position data, set ref.1 and 2 recalculate all other data.

Clicking right mouse button menu

 $\checkmark\,$ Del: delete the selected axis data.

 \checkmark Move To axis: Move the stage to selected axis data.





4.12 ^{12.3} Set Decimal Point

🛃 Display resolu	tion 🔀
Thk, Resol,	12,34 💌
Comp, Resol,	12,34 💌
CPS Resol,	12,34 💌
0	k Cancel

4.13 Cal File Select Window

Select calibration file									
	<i>international and all all all all all all all all all al</i>								
No 🛆	Mode	Beam	kV/uA	MCA	Primary	Date	Comments		
0	Y_Gold Quan(Emp)	3.000 mm	47kV/600uA	4096	1,Ta 25.0μm	3/27/2012-2:45 PM			
1	R_CuZn Quan(CSFP)	3.000 mm	50kV/352uA	2048	1,Ta 25.0μm	12/14/2012-11:46 AM			
2	D_Gold Quan(Emp)	3.000 mm	47kV/170uA	4096	1,Ta 25.0μm	2/13/2012-12:52 PM			
3	P_Gold Quan(Emp)	3.000 mm	47kV/150uA	4096	1,Ta 25.0μm	2/13/2012-1:40 PM			
4	Silver Quan(Emp)	3.000 mm	47kV/100uA	4096	0,None	2/13/2012-2:42 PM			
7	FP_STD Quan(CSFP)	3.000 mm	47kV/547uA	2048	1,Ta 25.0μm	10/25/2012-11:02 AM			
10	FP-STD Quan(CSFP)	3.000 mm	50kV/563uA	2048	6,Mo 50.0μm,Zn 20.0μm	10/25/2012-11:42 AM			
12	PE Quan(CSFP)	2.000 mm	50kV/856uA	2048	1,Ta 25.0μm	10/29/2012-4:10 PM			
16	Plastic Quan(Emp)	3.000 mm	50/1000,8/1000	4096	2,Mo 150.0µm	11/2/2012-12:34 PM			
17	RoHS_PE Quan(Emp)	3.000 mm	50/1000,8/1000	4096	2,Mo 150.0μm	11/9/2012-10:52 AM			
18	RoHS_Fe Quan(CSFP)	3.000 mm	50kV/352uA	2048	1,Ta 25.0μm	5/23/2012-1:01 PM			
19	RoHS_Al Quan(CSFP)	3.000 mm	50kV/306uA	2048	1,Ta 25.0μm	5/23/2012-1:42 PM			
20	RoHS_Sn Quan(CSFP)	1.000 mm	50kV/1000uA	2048	1,Ta 25.0μm	5/23/2012-2:16 PM			
21	RoHS_CuZn Quan(CSFP)	3.000 mm	50kV/352uA	2048	1,Ta 25.0µm	5/23/2012-9:51 AM			
22	RoHS_CuNi Quan(CSFP)	2.000 mm	50kV/816uA	2048	1,Ta 25.0µm	5/23/2012-4:59 PM			
23	%Ag/Sn//Cu/ABS Multi	0.400 mm	40kV/1000uA	4096	5,Ni 24.0µm	11/12/2012-1:10 PM			
26	%Au/Ni//Cu Multi	3.000 mm	50kV/204uA	4096	5,Ni 24.0µm	11/21/2012-3:27 PM			

- ✓ Set: Use the selected cal file.
 ✓ Edit comment: Edit the comment of selected cal file.
- ✓ Delete: Delete the selected cal file.

4.14 Recalibration Window

al data (Ui	nît : µm)					ReCalibration			
Edit S	etup					Select meas	uring row		
	Au Thk	Ni Thk	Au CPS	Ni CPS	Avg	and click	'Start'	Star	
А⊔∞			288.5	0.0		Cancel	Save	Otart	
Ni ∞		00	0.0	3086.0					
Cu Base			0.0	0.2					
Ni//Cu	1.000	1.02	0.0	952.9					
Ni//Cu	17 <u>2100</u> 23	5.21	0.0	2462.3					
Au//Cu	0.51		49.5	0.0					
Au//Cu	1.32		120.1	0.0					
Au//Ni ∞	0.81		74.7	1776.7					
Au//Ni ∞	1.32		121.1	1118.7					
Au/Ni//Cu	0.51	1.02	47.8	625.5					
Au/Ni//Cu	1.32	1.02	120.2	284.6					
Au/Ni//Cu	0.81	5.21	75.1	1380.4					
Au/Ni//Cu	1.32	5.21	120.4	861.5					

• Recalibration procedure.

1) Manual axis calibration.

- Set one calibration standard (ex: Au Inf.) on the stage.
- Adjust position and focus.
- Select desired (ex: Au Inf.) row on 'Calibration Data' window.
- Click 'START' button on Recalibration window.

- Click 'START' button again. Then average data will be used for calibration data.

2) Automatic axis calibration.

- Set all calibration standards on the stage.

- Adjust position and focus.

- Double click the desired (ex: Au Inf.) axis row then axis data will be registered.

- Register all of calibration standard axis data.

- Click the 'START' button.

3) Click the Right button of mouse will be display the pop-up menu.

View spectrum Clear selected CPS

Clear all CPS

Modify ROI

Modify Elem. Name

Delete one Row

- ✓ View Spectrum: display standard's spectrum on spectrum window.\
- ✓ Clear selected CPS: Clear CPS for selected row data.
- ✓ Clear all CPS: Clear entire CPS in Cal data.
- ✓ Modify ROI: Change ROI value as eV.
- ✓ Modify Elem. Name: Change element name.
- ✓ Delete one Row: Remove selected standard.

N New Calibration 4.15

4.15.1 Thickness Calibration

Click icon for new calibration (ex:Au/Ni//Cu)

New Calibration	
Set cal mode	
Au//Ni Excitation	•
Primary None - F	ocus Norm 👻
Beam size 0.300	*
Meas Time 10 Au 10 10 10	MCA Resolution 4096 -
High Voltage 50 kV 🗸	🛛 🗌 Remove Br
Tube current	
Auto set 1000 uA	•
Target Deadtime(%)	5
Start Cal.	Cancel

Double Click on Beam size, Meas Time and High Voltage, then Edit Cal. Mode window appears. Do as shown below.

al mode					Number
Mode	2 Multi			-	8
ayer Mea	as. Elemer	nt	Filter	Num.	7
1 🗹	Au	-	None 🔻	C(%) 🔻	Save
2 🔽	Ni 3	-	None 4	C(%) 🔻	
3	Cu	•	None 🔻	C(%) 🔻	Cance
4	None	•	None 🔻	Off 🔻	
5	None	•	None 🔻	Off •	Insert
					moore
6	None	ave mode	Co Filte	er auto set Detector	Del
6 🗌	None ROI 6 _S	• ave mode	Co Filte	er auto set Detector remove	Del
6 5 Set F	None ROI 6 _S n(@) ROI 1 L	ave mode	Co Filte	er auto set Detector remove 2 U	Del
6 5 Set F ROI Nun Layer Au	None ROI 65 n(@) ROI 1 L 11028	ave mode 1 U 11858	Co Filta Use Si Use Br	ar auto set Detector remove 2 U	Del
6 5 Set F ROI Num Layer Au Ni	None ROI 65 n(@) ROI 1 L 11028 7095	ave mode 1 U 11858 7861	Co Filt Use Si Use Br	er auto set Detector remove 2 U	
6 5 Set F ROI Nun Layer Au Ni	None ROI 6S n(@) ROI 1 L 11028 7095	ave mode 1 U 11858 7861	Co Filt Use Si Use Br	er auto set Detector remove 2 U	

Select Cal. Mode which is just created.

New Calibration	
Set cal mode	
Au//Ni Excitation	
Au//Ni Excitation Y_Gold Quantitative W_Gold Quantitative D_Gold Quantitative P_Gold Quantitative Silver Quantitative Test Quantitative RoHS Quantitative %Au/Ni//Cu Multi	(Target Dead time is 5% for
High Voltage 50 kV Remove Br	Proportional Counter, 30% for PIN
Tube current	Diode detector.
Auto set 1000 uA	
Target Deadtime(%) 12	
Start Cal. Cancel	

New calibration will use pre-defined cal mode. Click Start Cal. button, and enter number of standard foil.

Number of standard	X
Set number of Au//Ni standard. 1-12	OK Cancel
2	

Follow the message on New Calibration Window.

Set cal mode	
Au//Ni Excitation	
Primary None -	Focus Norm
Beam size 0.300)
Meas Time 10 Au 10 10	MCA Resolution 4096 -
High Voltage 50 kV Tube current ☑ Auto set 1000 Target Deadtime(%)	Remove B
Start Cal.	Cancel
Sta	art
Measuring	ntensity.

Click OK to accept tube current.

Manual input	
End of Measuring Intensity, Enter another value if you need,	ОК
Max Value = 1000 uA	Cancel
850	

Load reference standard and click start.



Example of Calibration

: Enter or modify the thickness and composition value.

Edit Se	etup							
	Au Thk	Ni Thk	Au CPS	Ni CPS	Avg	Х	Y	Z
Au∞	00		764.3	32.9	1			
Ni ∞		00	3.1	5715.8	1			
Cu∞			5.6	76.6	1			
Ni//Cu		6.72	6.1	471 <mark>1.6</mark>	1			
Au/Ni//Cu	1.09	6.72	274.8	2000.8	1		1	

Calibration	Data								
	Sn Thk Pb	Thk SnPb Th	ik % Sn	Sn CPS	Pb CPS	Avg	Х	Y	Z
Sn Inf	Inf		- 100%	5582.1	0.0	0			
Pb Inf	Ir	nf	- 0%	1.3	3449.8	0			
Cu Base				0.0	0.0	0			
SnPb Inf		Inf	<u>(58.0</u> 2	2577.8	1643.1	0			
Sn/Cu	10.50		- 100%	1931.8	6.3	0			
Sn/Cu	19.20/		- 100%	2916.2	4.4	0			
Pb/Cu	7	4.19	- 0%	0.0	1995.1	0			
Pb/Cu	\3	.22	0%	16.5	2861.1	0			
SnPb/Cu		(8.7	4 91.0%	1507.1	279.0	0			
SnPb/Cu		\ <u>\13.4</u>	18 <u>89.</u> 0%	2011.7	423.9	0			

Save new calibration.

4.15..2 Quantitative Calibration

Click icon for new calibration (ex: RoHs Plastic)

Set cal mode		
Au//Ni Excitation	on	
Primary Mo 1	<mark>I50.0μr →</mark> Focus	Norm
Beam size	3.000	
Meas Time 10 Au 10 10 10 10		MCA Resolutio 4096
High Voltage	50 kV 👻 🗆	Remove
Tube current	[1000 uA	~
Target Deag	ltime(%)	30
, arger board		

Double Click on Beam size, Meas Time and High Voltage, then Edit Cal. Mode window appears. Do as shown below.

🖳 Edit C	al. mo	de				X		P P	eriodi	c Tab	le											4		믜	8
Cal mo Mod	ode e 2	Quantitat	tive		•	Number 8		1 H		Nam Den: Kalk	ne:L sity:	ead 11,4	7	At, we	eight	: 207,1	2								2 He
Layer	Meas.	Eleme	nt	Filter	Num.			3 Li	4 Be	La(M ROI	(eV) : 1144	10.5 40~14	5 116							5 B	6 C	7 N	8 0	9 F	10 Ne
1	3	Cr,Br,Cd,	Hg,Pb	None T	Off ▼	6Save		11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 CI	18 Ar
3				None *	Off 👻	Cancel	1	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
4				None 🔻	Off *	4	1	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Вц	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 	54 Xe
6			,	App.	Name	Tinsert		55 Cs	56 Ba	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 r	78 Pt	79 Au	80 Hg	81	82 Pb	83 Bi	84 Po	85 At	86 Rn
4	Set RO	5 5	Save mode	RoHS	i Detector	Del		87 Fr	88 Ra	Pu	ill a	nd	dro	p e	len	nen	t to	ele	eme	ent	vin	dov	V		
BOL	New			Use Bi	r remove					57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb		
Lay	Num(@) ROI	10	2L	20					89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	A	: (89)		•
Cr		5044	5786																						
Br		11874	12266			=																			
Co	ł	22584	23764																						
Ho	,	11404	11874																						
PŁ	>	12266	13041			-																			

Select Cal. Mode which is just created.

New Calibration		
Set cal mode		
RoHS Quantitative	•]	
Au//Ni Excitation Y_Gold Quantitative W_Gold Quantitative D_Gold Quantitative P_Gold Quantitative Silver Quantitative Test Quantitative RoHS Quantitative To High Voltage 50 kV Tube current Q Auto set 1000 uA] Remove Br	Target Dead time is 5% for Proportional Counter, 30% for PIN Diode detector.
Start Cal.	Cancel	

Click Start Cal. And check as below.

Condition	Coefficient	Reports	Report Line	Report Std	Report MDL
Method		Re	gression met	hod	
Empi	rical	0	Ci = A1 + li +	A0	
◎ FP		0	li = Sum(Aj *	Cj) + A0	
CSFF	2	0	Ci = Sum(Aj	* lj) + A0	
📃 Naves e	-	0	Ci = Ai + li +	li * Sum(Aj *	Cj) + A0 <i#j></i#j>
🔄 Norma	anze set	0	Ci = Ai + li +	li * Sum(Aj *	lj) + A0 <i#j></i#j>
Interce	an a	۲	Ci = A1 * li +	A2 * li^2 + A	0
E Smoot	" hina		Remove esca	ne neak	
Remove	Background		Remove sum	peak	
🔽 Enat	ole (e	eV) 🛅	Use Net Area	B,G field	s 1
Iter 17	7 Bw 30		RTD OFF	🔲 Deco	ΠV.
		ſ	ОК		Cancel

Enter number of standard sample

Number of standard	X
Set number of RoHS standard, 3–50	OK Cancel
8	

Using around middle concentration of standard, get tube current by clicking Start.

Set cal mode	
RoHS Quantitative	
Primary Mo 150.0µr 👻	Focus Norm
Beam size 3.000	
Meas Time 10 RoHS 10 10	MCA Resolutio 4096 -
High Voltage 50 kV Tube current ✓ Auto set 1000 u Target Deadtime(%)	Remove I
5	
Start Cal.	Cancel

Click OK to accept tube current.

Manual input	×
End of Measuring Intensity, Enter another value if you need,	ОК
Max Value = 1000 uA	Cancel
850	

Load reference standard and click start.



Example of Calibration

Enter or modify the composition value in green box.

Cal data (Unit : ppm)

Edit S	etup										
	Cr ppm	Br ppm	Cd ppm	Hg ppm	Pb ppm	Cr CPS	Br CPS	Cd CPS	Hg CPS	Pb CPS	Avg
RoHS #1	0.0	0.0	0.0	0.0	0.0	2.6	12.5	13.2	1.5	27.0	
RoHS #2	404.0	538.0	104.0	201.0	403.0	7.2	338. <mark>3</mark>	23.4	28.8	110.7	
RoHS #3	1004.0	1042.0	302.0	1098.0	1208.0	<mark>14</mark> .1	665.8	<mark>40</mark> .8	126.3	238.5	

Edit	Setup											
	Dis	play resolu	ution	wt%	Au CPS	Aa CPS	Cu CPS	Zn CPS	Avg	х	Y	Z
G999	Cal	ibration ur	nit	•	ppm		8	71.8				1
G997	Aut	o Cycle		• •	wt%		9	71.2				
G996	Set	Condition			User-use	er.	D	69.7				
G993	Cha	ange Std N	lum.		Set User	define un	it 2	67.3				
G990	Rel	Calculation	ו ספייס	0.00	2605.1	<mark>9</mark> 5.2	12.4	70.1				
G916	91.57	8.41	0.00	0.00	2365.0	652.4	11.6	63.7				
G850	85.19	13.78	1.03	0.00	2148.7	10 <mark>51.4</mark>	32.7	58.5				
G800	80.18	17.82	2.00	0.00	1974.1	1338.9	48.6	54.4				
G750	75.10	12.34	11.57	0.99	1855.1	1030.9	285.9	92.2				
G700	70.21	9.21	19.60	0.98	1743.7	808.5	521.0	102.0				

- Display Resolution: change decimal point of Thickness, Concentration and CPS.
- ✓ Calibration Unit: Select concentration unit or specify unit
- ✓ Auto Cycle: Set acquiring time and waiting time.
- ✓ Set Condition: Select calibration parameters.
- ✓ Change Std. Num.: Add or delete standard.
- ✓ Recalculation: Recalculate calibration curve.

After acquiring all standard, calibration curve must be reviewed and change calibration parameters to get a good result. Go to Setup -> Set condition in Cal data window.

Condition	Coefficient	Reports	Report Line	Report Std	Report MDL
Method		Re	gression met	hod	
Emp	irical	0	Ci = A1 * li +	AO	
O FP		0	li = Sum(Aj *	Cj) + A0	
CSFF	2	0	Ci = Sum(Aj	* lj) + A0	
Norro:	alizo	0	Ci = Ai + li + l	i * Sum(Aj *	Cj) + A0 <i#j></i#j>
	alize pot	0	Ci = Ai + li + l	i * Sum(Aj *	lj) + A0 <i#j></i#j>
Inf, Ca	al	۲	Ci = A1 * li +	A2 * li^2 + A	0
📄 Smoo	thing	V	Remove esca	pe peak	
Remove	e Background		Hemove sum	peak;	
📝 Ena	ble (e	eV) 🔲 I	Use Net Area	B,G field	s 1
Iter 1	7 Bw 30	0	RTD OFF	🔲 Deco	nv,
6					
			ОК		Cancel

- ✓ Method: Select Empirical or FP- The unknown sample spectrum is compared to that of standards and the spectrum most similar is used for estimating the unknown sample's composition. Empirical models are applied where the coefficient matrix {Aij} is determined by regression analysis using a set of standard samples with known composition.
- ✓ Normalize: Select if total concentration is 100%
- ✓ Remove Background: Select If peak of element is not stand alone.
- ✓ Regression Method: select one of 6 equations.
 - #1: Ci = Ai * li.+ Ao
 - #2: li = Sum (Aj*Cj)+ Ao
 - #3: Ci = Sum (Aij*lj)+ Ao
 - #4: $Ci = Ai^{*}li + li^{*}Sum (Aj^{*}Cj) + Ao(i\#j)$
 - #5: Ci = Ai*li + Ii*Sum (Aj*lj) + Ao (i#j)
 - #6: $Ci = A_1 Ii + A_2 Ii^2 + A_0$
- ✓ Remove escape peak: Escape Peaks appearing as a result of the SiK radiation escaping from the Si detector, can be removed by enabling this selection.

- Remove sum peak: Sum, or pileup, peaks arise because two incoming x rays arrive at the pulse processor (amplifier) within a time frame that is less than the fast discriminator can detect the peak from the first event. This results in peaks that have energies with the sum of the two incoming x-ray events. For example, two incoming Fe-Kα photons (each with an energy of 6.4 keV), which pileup, would produce a count at 12.8 keV. This can be removed by enabling this selection.
- ✓ RTD OFF: RTD (Rise Time Discriminator) circuit has been implemented in the preamplifier. When RTD is active (RTD OFF is not checked), the shaped pulses are internally gated and only pulses corresponding to "good" X-ray events are allowed to be sent to the MCA for analysis. The RTD internal threshold is set to about 2 KeV. If energies less than 2 KeV are to be detected use RTD OFF function.

Repeat review and change calibration parameters to get good calibration curve.



Regression Condition window

In addition to graphic displays of the results, a detailed numeric report of the analysis results is provided by the Cal Condition window. It includes the regression coefficients and indices, the given and calculated concentration of each standard, and the absolute and relative difference between the given and calculated concentrations. In Report Line tab, the horizontal coordinate represents the specified concentration of the standard as input in the Cal data window; the vertical coordinate represents the calculated concentration as calculated by the regression model.

4.15.3 Plating Bath Calibration

Click icon for new calibration on the tool bar (ex: Sn-Pb content in plating bath)

Set cal mode	
Au//Ni Excitation	
Primary None -	Focus Norm
Beam size 0.300	
Meas Time	
Au	MCA Resolutio
10	4000
10	4096
High Voltage 50 kV	- 🗌 Remove E
Tube current	
Auto set 1000 u	A +
	· · · · · · · · · · · · · · · · · · ·
Target Deadtime(%)	5

Double Click on Beam size, Meas Time and High Voltage, then Edit Cal. Mode window appears. Do as shown below. Try to change numerical filter to get better result.

Cal mode						Number
Mode Z	Solution			•		12
Layer Meas.	Element		Filter	Num		-
1 23	SnPb		None 4	A(#)	-	7Save
2	Water	•	None -	Off	-	<u> </u>
3	None	•	None -	Off	-	Cance
4	None	•	None -	Off	-	-
5	None	•	None *	Off	-	Insert
6	None	•				Insort
5 Set RO	1 6 Sav	ve mode	Co Filte	er auto	set	Del
ROI Num(@	⊇) ROI		£			
Layer	1L	10	2 L	2	U	
Sn	585	700				1
0220	000	050				

Select Cal. Mode which is just created. Select biggest collimator and set measuring time as 100 sec. High Voltage must be adjusted regarding measuring element.

Set cal mode		
#SnPb//Water So	lution	
Primary None	- Focus	Norm
Beam size	0.3	
Cal. Time(Sec)	SnP	b 100
		30
		30
High Voltage	47.0 kV (240)	•
Tube current		
V Auto set	999 uA (255)	-
Maximum CPS		15000

Ex) ZnNi = 35KV, SnPb = 47KV

New calibration will use pre-defined cal mode. Click Start Cal. button, and enter number of solution standard.

Number of Solution standard	×
Set number of SnPb//Water Solution standard, 2–12	OK Cancel

Follow the message on New Calibration Window.

Load SnPb infinity, Sn infinity, Pb infinity and general water in sample cup and click start step by step.

ew Calibrat	tion			
Set cal m	ode			
#SnPb//\	Vater So	lution		-
Primary	None	- Foci	us	Norm -
Beam siz	ze	0.3		~
Cal. Tim	e(Sec)	-	-	1.229.1
		Sr	ηΡb	100
				30
				30
High Vo	ltage	47.0 kV (24	0)	*
Tube cu	irrent			
📝 Aut	o set	999 uA (255	5)	-
Maxim	um CPS			15000
Star	t Cal.		Car	ncel
	S	tart		
	Meas Set Sr	uring Intensit Pb ∞ standa	y. rd	

Click OK to accept tube current.

Manual input	X
End of Measuring Intensity, Enter another value if you need,	ОК
Max Value = 1000 uA	Cancel
850	

Load reference standard and click start.

Start Cancel Offset: 1501 Gain : 3712	Secur	and clic	nce Sta k 'Start'	ndard	
Gain : 3712	Start	Cancol	Offset:	1501	
	Start	Cancer	Gain :	3712	

Example of Calibration

\bigcirc	: Enter	or mo	odify the c	ompositio	n val
Cal data (U	Init :)				
Edit S	Setup				
	Sn	Pb	Sn CPS	Pb CPS	Avg
SnPb #1	6.00	1.00			
SnPb #2	13.00	2.00			

Prepare Plating water standards as follows (Example). Plating water standards must be measured by AAS to verify its concentration.

SnPb #1 = Sn 6g/L+Pb 1g/L

SnPb #2 = Sn 13g/L+Pb 2g/L





Sample Cup preparation (Substitution)



Mark Circle for measuring area



4.16 System Adjustment Window

4.16.3 General



System Adjust is for positioning to the right energy location of the known peaks in KeV using Reference Standard which is contained Cu and Sn.

Load Reference standard on the stage and adjust XY & focus. Click 'START' button to adjust.

System will turn on X-Ray several times and adjust the value of the Offset and Gain automatically to find proper position for Cu and Sn peaks.

4.16.4 Concept of the system adjust

Reference Standard contains two elements, Cu and Sn. The energy of the Cu is 8.048Kev and Sn is 25.27 KeV.

A good example of the System Adjust likes the following figure.







On/Off Focus Laser.

Cn/Off Lamp for Camera.

tγ

Set Y Stage Auto Move

Analysis position moves to near door side when cover is opened and moves to analysis position automatically when cover is closed.

4.20 Ac Auto Cycle Measurement Enable statistical Measurement.

4.21

4.18

4.19

A1.. Auto Cycle Number Enter Number of Analysis for Auto Cycle Measurement.

5. How to Measure

5.1 Loading Sample

- Open the door. The stage will move forward when 'Push Pull' (\downarrow function is ON.

- Load sample at laser beam position on the stage.
- Close the door. The stage will move backward.

- Adjust the sample by using stage control window.

5.2 Adjust Focus

- Adjust Focus laser to vertical scale line.



5.3 Select Cal File and Click Start Button.

MicroP Co., Ltd.

6. Maintenance

Following these maintenance steps will insure normal and reliable operation of the system. This maintenance is intended to be performed by the operator.

1) Fan Filters

Once a month clean the cabinet fan filter.

2) Sample Chamber

The stage might have a problem if the chamber is not clean, especially if volatile liquid or porous materials contaminate it. In a dirty chamber, there always exists the risk that some particles or liquid will accumulate on the surface of the thin Be window.

3) Si PIN Detector

The detector window is made of Beryllium foil, only 12.5 microns thick. Beryllium is a very corrosive element: water and many other liquids and particles can interact with it and generate pinholes within a short period. The result is loss of the vacuum in the detector cryostat.

4) Follow the maintenance instructions in the computer's manual to assure its proper operation.

7. Troubleshooting

This sub-section offers assistance in correctly diagnosing and possibly correcting common problems. Emphasis has been put on problems that arise from incorrect operation or settings, or other difficulties that can easily be corrected by simple means. In general, only trained service personnel must solve hardware problems.

Warning:

Do not attempt to repair the system on your own. Consult your service agent before trying to repair any hardware failures.

An accurate description of the problem is essential for the effective assistance from the service department. When dealing with a problem related to operation or analysis results, the most effective initial step is to relate the problem to one of the following main categories:

1. Hardware or software

2. Method and/or data associated with problem

3. Operator/Operation

Any connection between the problem and an action preceding it or an environmental cause may help in the identification of the problem's source.

A further aid is to define the problem nature by the following criteria:

1. Is the problem always the same?

2. Does the problem appear at regular intervals or random intervals?

The correct answers to many of the questions suggested above may not be an easy task, although the solution to many may be very simple.

The XRF-2000 constantly monitor the major signals and component operations in the system. Many problems, usually hardware and operation-related are

• No System Response

When the system has no response massage,

- 1. The USB communication cable on the computer side is not connected or the connector is bad.
- 2. Turn off the system and turn it on after 5 second.
- 3. Check Power on Lamp on the main switch. If power on lamp is not illuminate, check the main fuse on rear side of system.

• Peaks Not in the Correct Position

The proper way to verify energy calibration is to perform system adjustment as described in Chapter 4.16. Common reasons for peak shifts are:

- Cabinet heat-up due to dust in the filter or faulty fans.
- Big environment temperature change

• No X-rays

X-rays generation is off in the following reasons:

- Sample chamber cover open, or not fully closed.
- Acquisition is completed.

X-ray Tube Related Problems

High Voltage breakdowns are identified by sudden changes in the HV and tube current readings on monitoring in the software.

• X-ray Tube Oil

Routinely check for oil leakage from the x-ray tube housing and inside chamber. If a leak is noted, discontinue operation immediately and contact your service engineer.

Warning:

The insulating oil is processed in the factory to attain high dielectric strength. Please consult with the service agent before attempting to add or replace the oil.

Appendix

A. X-RAY FLUORESCENCE (XRF)

When a primary x-ray excitation source from an x-ray tube or a radioactive source strikes a sample, the x-ray can either be absorbed by the atom or scattered through the material. The process in which an x-ray is absorbed by the atom by transferring all of its energy to an innermost electron is called the "photoelectric effect." During this process, if the primary x-ray had sufficient energy, electrons are ejected from the inner shells, creating vacancies. These vacancies present an unstable condition for the atom.

As the atom returns to its stable condition, electrons from the outer shells are transferred to the inner shells and in the process giving off a characteristic x-ray whose energy is the difference between the two binding energies of the corresponding shells. The emitted x-rays produced from this process are called "X-ray Fluorescence," or XRF. The process of detecting and analyzing the emitted x-rays is called "X-ray Fluorescence Analysis." In most cases the innermost K and L shells are involved in XRF detection.

A typical x-ray spectrum from an irradiated sample will display multiple peaks of different intensities.

The characteristic x-rays are labeled as K, L, M or N to denote the shells they originated from.

Another designation alpha (α), beta (β) or gamma (γ) is made to mark the x-rays that originated from the transitions of electrons from higher shells. Hence, a K α x-ray is produced from a transition of an electron from the L to the K shell, and a K β x-ray is produced from a transition of an electron from the M to a K shell, etc. Since within the shells there are multiple orbits of higher and lower binding energy electrons, a further designation is made as α 1, α 2 or β 1, β 2, etc. to denote transitions of electrons from these orbits into the same lower shell.

The XRF method is widely used to measure the elemental composition of materials. Since this method is fast and non-destructive to the sample, it is the method of choice for field applications and industrial production for control of materials. Depending on the application, XRF can be produced by using not only x-rays but also other primary excitation sources like alpha particles, protons or high energy electron beams.

Sometimes, as the atom returns to its stable condition, instead of emitting a characteristic x-ray it transfers the excitation energy directly to one of the outer electrons, causing it to be ejected from the atom. The ejected electron is called an "Auger" electron. This process is a competing process to the XRF. Auger electrons are more probable in the low Z elements than in the high Z elements.


Appendix B

New Calibration for Disk (V5 Version)

Thickness Calibration (ex: NiP//Al)

- 1. On Main Window, Go File \rightarrow Administrator Login \rightarrow "t" \rightarrow Enter.
- 2. Click icon for new calibration on tools Bar and set as shown below.

New Calibration
Set cal mode
NiP//Al Quadratic
Primary 0.None
Beam size 4.000 V Focus Norm V
Meas Time
Time Elm Sys. MCA
30 NiP C Real Resolution
€ Live 4096 -
High Voltage 30 kV 💌 🔽 Use ICR
Tube current
Auto set 1000 uA
Target Deadtime(%) 25
Start Cal. Cancel

- ✓ Select cal mode: Select application. If not exist, Double Click on Beam size, Meas Time and High Voltage and perform step 3.
- ✓ Beam size: Select collimator size.
- ✓ Time: Set measuring Time.
- ✓ Sys: Select Live for live time regarding Dead Time.
- ✓ MCA: Select MCA channel.
- ✓ High Voltage: Set Tube high voltage for element to be analyzed. (ex-30KV for NiP)
- ✓ Use ICR: Check for background ROI.
- ✓ Tube Current: Check Auto set to get optimized TC at target Dead time. Target Dead time: Set 25%
- 3. To create cal mode, double Click on Beam size, Meas Time and High Voltage in the new Calibration Window, then Edit Cal. Mode window appears. Set as shown below.

Edit Cal.	mode				Number		
Mode	2 Quadratic	(-			
Layer Mea	as. Elemer	nt	Filter	Num.	6		
12	NiP	-	None 💌	Off 🔽	Save		
2	AI	-	None 💌	Off 🔽			
3 🗖	None	-	None	Off 🔽	Cancel		
4 🗖	None	-	None	Off 🔽	-		
5 🗖	None	-	None 💌	Off 👻	1 Insert		
6 T	None	-			moore		
4 Set F		ave mode	Co Filt	er auto set Detector remove	Del		
Laver	1L	1U	2L	2 U			
NiP	5824	9518					
		2		9			
-				2			
			÷	365. 			

4. Click

Button in the new Calibration Window to proceed.

5. Enter number of standard foil.

Start Cal.

Number of standard	
Set number of NiP//Al standard,	ОК
5-20	Cancel

6. Follow the message in the New Calibration Window to get optimized Tube Current.

New Calibration
Set cal mode
NiP//Al Quadratic
Primary 0,None
Beam 4.000 Focus Norm 🕶
Meas Time Sys. MCA 30 NiP C Real G Live 4096
High Voltage 30 kV ▼ M Use ICR Tube current M Auto set 1000 uA ▼ Target Deadtime(%) 25
Start Cal. Cancel
Start
Measuring Intensity. Set NiP or Thick disk standard and click 'START'



8. Enter thickness value for each standard and load standard into chamber and click Start button in the new Calibration Window.

Cal data (Unit : µn	n)					
Edit Setup							
	NiP Thk	NiP CPS	Avg	Х	Y	Z	
NiP//Al #1	14.55						
NiP//AI #2	12.07						
NiP//Al #3	11.04						
NiP//AI #4	9.32						
NiP//Al #5	9.08						

New Calibration	
Set cal mode	
NiP//Al Quadratic	•
Primary 0.None	*
Beam size 4.000	Focus Norm
Meas Time	
Time Elm Sys.	Resolution
SU NIP	ve 4096 -
Tube current Auto set 405 (Target Deadtime(%)	JA 25
Save	Cancel
Sta	art
Enter the stand and select row	dard value to measure

✓ Example of Calibration

Cal data (Unit : µn	1)				
Edit Setup						
	NiP Thk	NiP CPS	Avg	Х	Y	Z
NiP//Al #1	14.55	74133.5				
NiP//AI #2	12.07	68485.6				
NiP//AI #3	11.04	62946.4				
NiP//Al #4	9.32	60900.4				
NiP//AI #5	9.08	60371.2				

9. Click Save

button to save new calibration File.

Set cal mode	
NiP//Al Quadratic	~
Primary 0,None	-
Beam size 4.000	Focus Norm
Meas Time	
Time Elm Sys.	MCA
30 NiP C Re	eal Resolution
© Liv	/e 4096 🚬
Auto set 405 u	A 💌
Target Deadtime(%)	25
Target Deadtime(%)	Cancel
Target Deadtime(%) Save Sta	Cancel
Target Deadtime(%) Save Sta	Cancel Int
Target Deadtime(%) Save Save Enter the stand and select row t	Cancel Cancel Int lard value o measure

. (

✓ Click Hindom Stage on Tool Bar. Random Stage(Sample01) X Setup $\downarrow \downarrow$ Ø No х Y Ζ 118.35 90.11 32.40 1 2 118.35 90.11 32.40 118.35 3 90.11 32.40

10. Using Random Stage Recipe

✓ Open position Data file.

- ✓ Click Pencil Icon.
- ✓ Click Car Icon to run.

🔡 Random S	itage Meas, Average Windows	<u>×</u>
Randon	n Stage Recipe	
Sample	901	
Avera	age	
	2.75 µm	

Appendix C

New Calibration for RoHS_Plastic

- 1. Step

 Go File -> Administrator Login -> "t" -> O.K.
 Click icon for new calibration (ex: RoHs Plastic)

 Select New Cal Mode

 Method
 Thickness
 Emp/MPFP
 CSFP
 OK Cancel
 - Set acquisition parameters as shown below.

New Calibration for Quantitative Step Laver Std Intensity	
TC 1000 uA HV 50 kV RTD OFF Primary 2,Mo 150.0µm Collimator 3.000	Common Method Emp MPFP Quan ROHS
Dead time 25 Cal. Time 300 Step Step HV TC Col Pri Time Kind.CRM RTD Off	MCA Res. 4096 Vinit ppm Vinit

- Load middle range concentration of standard samples.
- Click Auto set TC button, then system will show you optimized TC value.
- Click Add Step button.
- If you have another standard samples such as CI (Halogen Free) which means multi-acquisition parameters, repeat again using different acquisition parameters.
- The final settings are as follows for multi-acquisition parameters.

1000 uA 👻		•	Prima	HV ry	V 8.0 kV RTD OFF O,None			OFF	Method Emp MPFP			Mode © Quan. ROHS	
)ead t	ime	25	Collimato Cal. Tim	or Ie	3.000		•	Add Step M	ICA Re	s. [41	96 🔻	Unit	ppm
Step	HV	TC	Col	_	Pri		Time	Kind.CRM	RT	Off			
0	50	1000	3.000	•	2,Mo 150.0µm	•	300	0	(
1	8	1000	3.000	-	0,None	•	300	1	(

2. Layer

- Click periodic table on tool bar and drag element to be analyzed into layer window. The final settings are as shown bellow.

3. Std

p La	yer Std	Inte	nsity								
Current C Decimal I	RM Point for Cor	O nc.	▼ 2	Std	Name Cl_	High		Add	l Std		Measuring Std
Name	Spectrum	Х	Y	Z	Cr	Br	Cd	Hg	Pb	CI	
E_Blk		135.5	4 88.3	24.03	0.00	0.00	0.00	0.00	0.00		
E_Low		98.65	88.3	24.45	404.00	538.00	104.00	201.00	403.00		
E_High		69.92	88.3	0 24.34	1004.00	1042.00	302.00	1098.00	1208.00		
New Ca	libration fo	or Qua	ntitativ	e							
New Ca ap La Current (libration fo ayer Std CRM	or Qua	ntitativ ensity	e							
New Ca ep La Current (Decimal	libration fo ayer Std CRM Point for Co	or Qua Inte 1	ntitativ ensity 2	e Std	Name Cl	High		Add	Std		Measuring Std
New Ca ap La Current C Decimal Name	libration fo ayer Std CRM Point for Co Spectrum	or Qua Inte 1 nc. X	ntitativ ensity 2 Y	e Std Z Cr	Name Cl. Br Cd	High Hg Pb	a	Add	Std		Measuring Std
New Ca ap La Current C Decimal Name	libration fo ayer Std CRM Point for Co Spectrum	nc. X 0.00 (ntitativ ensity 2 Y 0.00 0.	e Std Z Cr 00	Name Cl. Br Cd	High Hg Pb	CI 0.00	Add	Std		Measuring Std
New Ca ap Lz Current C Decimal Name 1_Bik 1_Low	libration fo ayer Std CRM Point for Co Spectrum	or Quar Inte 1 nc. X 0.00 (0	rtitativ ensity 2 Y 0.00 0. 0.00 0.	e Std Z Cr 00	Name Cl	High Hg Pb	Cl 0.00 530.00	Add	Std		Measuring Std
New Ca ep Lz Current C Decimal Name C_Blk 1_High	libration fo ayer Std CRM Point for Co Spectrum	or Quar Inte 1 nc. X 0.00 (0.00 (0.00 (rnsity ensity 2 Y 0.00 0. 0.00 0. 0.00 0.	e Std Z Cr 00 00	Name Cl	High Hg Pb	Cl 0.00 530.00 1300.00	Add	Std		Measuring Std

- Enter Standard Name for Layer 0 and Layer 1 as below.

- Click one of standard name and load standard sample in chamber the click Measuring Std.

ep La Current (Decimal	RM Point for Cor	0 nc.	sity ▼ 2	Std N	lame Cl_	High		Add	l Std		Measuring Std
Name	Spectrum	Х	Y	Ζ	Cr	Br	Cd	Hg	Pb	CI	
PE_Blk		135.54	88.30	24.03	0.00	0.00	0.00	0.00	0.00		
E_Low		98.65	88.30	24.45	404.00	538.00	104.00	201.00	403.00		
E_High		69.92	88.30	24.34	1004.00	1042.00	302.00	1098.00	1208.00		

- Repeat measuring for layer 1 as layer 0.
- 4. Intensity

Finally check intensity for each layer as follows.

iep La	ayer 3	Std	Intensity				0-54 Z2	
Current (Decimal	CRM Point fo	0 r Intensit	y 2	• •	Applicatio	n Name	View & Set Condtion	Save to CalFile
Std	Cr	Br	Cd	Hg	Pb	a		
PE_Blk	3.70	5.70	7.90	5.20	15.50			
PE_Low	12.90	432.70	31.60	427.90	159.20			
PE_High	7.20	219.80	18.00	216.60	68.30			

.op	Layer	St	d	Inter	nsity					
Current CRM			l	Ê.	1		•) App	View & Set	
Decin	nal Poir	t for	Inten	sity	2][Condtion	Save to CalFile		
Std	Cr	Br	Cd	Hg	Pb	CI				
CI_BI	¢					21.70				
CI_Lov	N					22.40				
CI_Hig	h					24.30				

5. Save CAL File

- Enter Application Name and click Save to CalFile.

ep l	ayer	St	d	Inter	nsity				
Current Decima	CRM al Poin	t for	1 Inten:	sity	2	A¢ RoHS	PE	View & Set Condtion	Save to CalFile
Std	Cr	Br	Cd	Hg	Pb	CI			
CI_BIk						21.70			
Cl_Low						22.40			
1_High						24.30			

D. Calibration for CSFP

This procedure is for unsatisfied FP result or new FP calibration.

- 1. Login and get Factory service
 - ✓ On main window, go File -> Administrator Login -> "t" -> O.K.
 - Place cursor on Main window and click the Main window then press Alt+Ctrl+Shif simultaneously and hold these keys and type "pioneerok". Then factory menu will appear on tool bar.



✓ Perform System Adjustment (Refer to step 4.16 in Operating manual).

2. Click Factory icon.

	1	
Col Test	Col Set	T.C Test
EEPROM Set	Layer 2 Over	Pri Lens
Registry Set	Num. Ref	CSFP Cal.

3. Click CSFP Cal.

•	Making	g EXC				
0	Calibrate	g EXC	Measuri	ng spectrum Making E×	(C)	
	ΗV	TC	Col	Pri, Filter	Date	
	50	352	3,000	1, Ta 25, 0µm	11/21/2012 5:11:12 PM	
	50	50	2,000	0,None	11/22/2012 2:16:20 PM	
	50	568	3,000	6,Mo 50,0µm,Zn 20,0µm	11/22/2012 3:20:44 PM	
	47	547	3,000	1, Ta 25, 0µm	12/10/2012 11:23:02 AM	

A. Calibrated EXC

Calibrated conditions are listed which are various combination with High Voltage, Tube Current, Collimator and Primary Filter. If you are first time to use FP, you will see blank. In case of unsatisfied FP result, delete all existing lines by clicking right mouse and delete, after that build up all combination of acquisition parameters again in next step.

- B. Measuring spectrum
 - ♦ Load FP Standard provided by MicroP Co., Ltd in to sample chamber.

🛃 Making EX	KC								
Calibrated EX	КC	Measuring spectrum Making EXC							
Primary filte	er	2,Mo 150.0µm							
High Voltage	э	47 kV	▼ Target Deadtime(%) 25						
Tube Cur,		Auto	▼ Meas Time(Sec) 300						
Collimator		3.000	▼ MCA Resolution 2048 ▼						
Add Step		Meas	Making EXC after measuring						
HV TC		Col	Pri, Filter						
50 Au	ito	3,000	1, Ta 25, 0μm						
50 Au	ıto	3,000	6,Mo 50,0µm,Zn 20,0µm						
47 Au	ıto	3,000	2,Mo 150,0µm						

- ✓ Add Step: Select acquisition parameter (PF, HV, TC, Col) and click Add Step.
- ✓ Target Dead Time is optimized as 25%
- ✓ Meas Time is optimized as 300 sec.
- MCA resolution is optimized as 2048 channel. More channels will take more time to calculate FP parameters and total measuring time.
- ✓ Making EXC after measuring: Currently not in use.
- Meas: After set all acquisition parameters to be used in your system or additional need then click Meas. System will adjust TC to get 25% D.time and acquire spectrum step by step and save it.

4. Making Exc

•-	FP CAL	(FPSTI	D)				
ſ	Calibrated	EXC M	leasuring sp	ectrum	Making EXC		
	Sym	No	Fit Line	C	onc(%)		
	In	49	KA,KB,L		5,98		
	Sn	50	KA,KB,L		8,86		🗖 Save input file
	Ag	47	KA,KB,L		4,00		
	Au	79	L3,L2,L1		3,02		Do All File
	Cu	29	KA,KB		10,05		
	Ni	28	KA,KB		18,19		
	Fe	26	KA,KB		18,19		Do Selected File
	Pd	46	KA,KB,L		3,75		
	Ti	22	KA,KB		5,05		
	Zr	40	KA,KB		2,63		
	Mo	42	KA,KB		9,30	Ţ	
	-	-					

- ✓ Click Periodic table and drag and drop elements into making EXC window.
- Enter Fit Line and Concentration. The FP standard composition is as follow.

alibrate	d EXC	Measuring spe	ctrum Making EXC	
Sym	No	Fit Line	Conc(%)	•
In	49	KA,KB,L	5,98	
Sn	50	KA,KB,L	8,86	🗖 Save input file
Ag	47	KA,KB,L	4,00	
Au	79	L3,L2,L1	3,02	Do All File
Cu	29	KA,KB	10,05	
Ni	28	KA,KB	18, 19	
Fe	26	KA,KB	18, 19	Do Selected File
Pd	46	KA,KB,L	3, 75	
Ti	22	KA,KB	5,05	
Zr	40	KA,KB	2,63	-
Mo	42	KA,KB	9,30	
Cr	24	KA,KB	10,86	
Zn	30	KA,KB	0,12	_

alibrate	d EXC	Measuring sp	bectrum Making EXC	
Sym	No	Fit Line	Conc(%)	
Ag	47	KA,KB,L	4,00	
Au	79	L3,L2,L1	3,02	Save input file
Cu	29	KA,KB	10,05	
Ni	28	KA	Delete	Do All File
Fe	26	KA I	Delete All	
Pd	46	KA, I	Open	
Ti	22	KA	Save	Do Selected File
Zr	40	KA,KB	2,63	
Mo	42	KA,KB	9,30	
Cr	24	KA,KB	10,86	
Zn	30	KA,KB	0.12	

- ✓ This table can be deleted line by line or all and saved or opened by right click of mouse.
- Click Do All file to create excitation files for all spectrum or click Do Selected File for specific spectrum.
- ✓ The final excitation file will be shown on spectrum window as follow.

