

Documentation Stationary Metal Analyzers SPARK ANALYZER

Boschstr. 10
D-47533 Kleve

Manual Version 05/2001
Software Version 3.00






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1 Contents Overview

The program Spark Analyzer is used to control the stationary metal analyzers manufactured by SPECTRO Analytical Instruments. This system supports you during daily operating the spectrometer. Parts of this manual applying for special device types are marked with ,  and .

The following items are available:



Bases

- ✓ Important Notes
- ✓ Operating Windows-Programs
- ✓ System Description
- ✓ Technical Data
- ✓ Periodic Maintenance
- ✓ Spectro-Service



Software Description

- ✓ Software Structure
- ✓ Measure Window
- ✓ Sample Manager
- ✓ Program Development
- ✓ Regression
- ✓ Scan Manager Monochromator
- ✓ Scan Manager CCD



Procedure

- ✓ Routine Operating
- ✓ Carry out a Standardization
- ✓ Carry out a Calibration
- ✓ Carry out a Type Standardization
- ✓ Carry out a Type Calibration
- ✓ Carry out a Control Sample Test
- ✓ Carry out an Alloy Grade Search
- ✓ Carry out an Alloy Grade Check
- ✓ Carry out a SIM Reprofilng
- ✓ Carry out a Monochromator Reprofilng (instruments with monochromator)
- ✓ Operating a Monochromator (instruments with monochromator)



Function Keys



Parameter Files



Tips & Tricks



Troubleshooting



Glossary

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2 Important Notes

This chapter provides you with important safety instructions and information about data saving and diskette types; please note the information for your daily operation with the Spectrometer.

Safety Instructions

Please take notice of the following safety instructions when operating the spectrometer:

- ➔ During operation, maintenance, or repair, regulations for prevention of accidents, given by the official bodies, must be observed.
- ➔ Maintenance and repair work shall be carried out by qualified personnel exclusively!
- ➔ A periodic inspection of the equipment by qualified specialists increases reliability and life time of the equipment.
- ➔ During operation, maintenance, repair no safety device must be bypassed!
- ➔ Observe the safety information labels posted with the equipment!
- ➔ Use SPECTRO spare parts exclusively!
- ➔ The equipment must only be connected to mains with proper grounding.
- ➔ Disconnect the equipment from mains before removing the casing.

Data Saving

A periodic data saving is an important feature for reliable operation and access to your analysis system. You should carry out periodic data saving of the program-subdirectory by means of the tools provided for the operating system. In case of a complete failure of your PC or data, you can easily restore the data on a new computer or a new installed software. Keep the respective data carriers at a safe distance from your PC.

Copyright and Warranty

Spark Analyzer for Stationary Metal Analyzers.

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3 Operating Windows Programs

The user interface consists of standard-Windows-elements like scalable windows, dialog boxes, scroll bars and push buttons. If you should not be familiar with these elements, look up in your Microsoft Windows-Documentation or consult the help system of the program manager.

➔ **Using the Keyboard and /or the Mouse**

This software is designed for easy use with keyboard and / or mouse. This chapter describes how to operate the general standard functions with keys and key combinations.

➔ **Switching the Application Windows**

One of the advantages of Windows software is Multi-Tasking, this is possible within the spectrometer software too. You can run a function in the background whilst something different is performed in the foreground.

➔ **Working on Tables**

Tables are used to manage data and to lay out the information clearly. Tables are displayed in several windows of the software.

3.1 Using the Keyboard and/or the Mouse

This software is designed for easy use of keyboard and / or mouse. Using the arrow keys, the spacebar, the enter key, each element and each option may be called up. Additionally each function and option may be accessed with a shortcut. Most operations in this software may be operated by easy clicking the respective element with the mouse.

Description of standard functions:

- ➔ The <Tab> key moves the cursor to the next field in a window or a dialog box.
- ➔ The <Shift><Tab> key combination moves the mark bar back to the preceding field in a window or a dialog box.
- ➔ The <Arrow Keys> move the cursor or the mark bar in the resp. direction to the next text box or check box. In a text box use the left and right arrow key to move the cursor one character to the left or to the right. Press <Up> and <Down> keys to move up and down in a list box.
- ➔ The <Enter> key enables the check box which was selected or generally enabled. The check box is characterized by two frames, a thick one and a dotted one around the check box text.
- ➔ The <Spacebar> enables and disables check boxes, push buttons, list box elements.
- ➔ The <Home> key moves the cursor to the begin of a list or a text box.
- ➔ The <End> key moves the cursor to the end of a list or a text box.
- ➔ The <Page Up> key scrolls in a list box upwards.
- ➔ The <Page Down> key scrolls in a list box downwards.
- ➔ The <F1> key displays help texts assigned to the current elements.
- ➔ The <F10> key enables the menu bar to open menus by the arrow keys.
- ➔ The <Esc> key stops the current operation and returns to the preceding window.

➔ The <Access> keys are the underlined characters of most words in the dialog boxes or menus. The underlined character is also called 'hotkey' and facilitates the fast selection of program elements. To select an element with such a key, hold down the <Alt> key and press the respective character in addition. The cursor jumps immediately to the word containing the character and enables the element in the same way as pressing the enter key.

See:

Operating Windows Programs

3.2 Working on Tables

Tables are used to manage data and to lay out the information clearly. Tables are displayed in several windows of the software; e.g. the list box on the samples to be measured in the application field of the sample manager and the survey on the available scans in the application window of the scan manager. Generally the handling of tables is equivalent to other applications. The key assignment is used in the same way as modifications on the tables are carried out. The available functions and the use of the keys is described below:

<Cursor Up>	enables the field above the current field
<Cursor Down>	enables the field below the current field
<Cursor Left>	enables the field left to the current field
<Cursor Right>	enables the field right to the current field
<Shift><Cursor>	extends the field selection
<Page Up>	moves the current field one page upwards
<Page Down>	moves the current field one page downwards
<Ctrl><Page Up>	moves the current field one page to the left
<Ctrl><Page Down>	moves the current field one page to the right
<Home>	moves the current field to the beginning of the first row
<End>	moves the current field to the last field which contains data
<Ctrl><Home>	moves the current field to the first field of the first column in the first row
<Ctrl><End>	moves the current field to the last field of the last column in the last row which contains data
<Tab>	moves the current field to the next field (from left to right, from above to below)
<Shift><Tab>	moves the current field to the preceding field
<Shift><Spacebar>	selects the current row
<Ctrl><Spacebar>	selects the current column
<Shift><Ctrl><Spacebar>	selects the complete table
<Shift>	deletes the content of the current field or the highlighted area and stores it on the clipboard
<Shift><Ins>	inserts the content of the clipboard into the current field
<Ctrl><Ins>	copies the content of the current field or the highlighted area on the clipboard
<Enter>	disables the active edit mode
<Esc>	disables the active edit mode and overwrites the content of the current field with the content of the preceding field
<F2>	deletes the content of the current field, in case the edit mode is enabled

See:

Operating Windows Programs

3.3 Switching the Application Windows

One of the advantages of Windows software is Multi-Tasking, this is possible within the spectrometer software too. You can run a function in the background whilst something different is performed in the foreground.

E.g. all steps of the method creation may be carried out whilst samples are measured with the routine window in the background. Additionally a switch to another application is possible without losing data and with no need to shut down the window.

The fastest way to switch between application windows is to use the key combination <Alt><Tab>. Hold down the <Alt> key and trigger the <Tab> key; with each push on the <Tab> key a new symbol of the various application windows is displayed. The selected application window is called up in the moment you release the <Alt> key.

See:

Operating Windows Programs

4 System Description

This system description provides an overview of the following:

- ➔ Basics of Optical Emission Spectrometry
- ➔ Evaluation of the Measurement Results
- ➔ Mode of Operation

4.1 Optical Emission Spectrometry

Below you find a short introduction and a historical survey on optical emission spectrometry.

In the course of the 17th century the Englishman Isaac Newton discovered that sunlight is dispersed into its components by means of a glass prism. The spectral colors (rainbow colors) were found. Additionally he managed to unify the diffracted light back to white light by a second prism.

Newton took the light for a particle radiation, whilst his dutch contemporary Christiaan Huygens took light for a wave phenomena (similar to sound waves). Since the discovery of the electromagnetic waves by the German Heinrich Hertz (about 1887) we know that light is a small part of the electromagnetic spectrum. With that the opinion of Huygens had been confirmed, because e.g. the dispersion of light by means of an optical diffraction grating into its components prerequisites a wave nature of light. But the opinion of Newton had been confirmed too. An example is the photo electrical effect we are using for light measurement by a photomultiplier. The photo electrical effect prerequisites that light consists of single particles whose energy is inversely proportional to their wavelength. Due to this finding the Nobel prize on physics was awarded to Albert Einstein in 1927. Consequently light is of dual nature: once it behaves as a wave, once as a particle.

The dispersion of light in a prism into its single components (wavelengths) is based on the dependence of light propagation in glass on the wavelength; blue light (wavelength about 450nm) is diffracted more than red light (wavelength about 750nm). This may be observed by means of a prism spectrograph. In case sunlight is let into such a device, a continuous spectrum is generated on the outlet: all colors from red to violet merge each other without limitations. In this case the prism spectrograph acts as a spectroscope. If you put a gas flame in front of the spectroscope and bring some common salt (NaCl) into the flame, two very bright yellow slit images will appear side by side. Because the slit images are narrow sharp lines, the name spectral lines or simply lines became usual.

In Heidelberg the Germans Robert Wilhelm Bunsen and Gustav Robert Kirchhoff investigated systematically the appearance of spectral lines of flames. They realized the following three facts: the effects are based on processes in the atoms, the various atom types (the elements) radiate different spectral lines, the appearance of some definite spectral lines may be used as a proof on the presence of definite elements. When they had published these results in 1860, the foundations for the chemical spectral analysis were laid.

In a simple flame only spectral lines of some few elements are to be found. Only few elements are vaporized and excited to emit the characteristic spectral lines. To vaporize and excite the most elements the temperature of a simple flame is too low. However in an arc and in an electric spark all elements are vaporized and excited.

After the finding that the emission of spectral lines is based on processes within the atoms, the wavelengths of the lines observed were measured carefully. In 1865 the Swiss Johann Jakob Balmer developed a very simple formula on the wavelengths of the hydrogen lines. Based on the Balmer formula today's atom theory was developed. The most important of this theory with view to the spectral analysis is the following:

An atom consists of both, a positive nucleus and negative electrons, circling the nucleus on definite orbits, similar to the planets on the orbits around the sun. Caused by energy supply (e.g. heating up by an electric spark) an electron may be moved up to an outer orbit; the electron takes up energy and transforms from base energy level to an excited level. Because there are only very special, limited excited levels, the atom can only pick up definite amounts (discrete) of energy. Returning to the base energy level or a lower excited level a definite amount of energy is released. This discrete energy appears as a light particle (photon) of a definite wavelength.

In the beginning the spectrums were viewed visually by means of a spectroscope, but later on the spectrums were photographed. For that a photo plate was mounted in the focal plane of the spectroscope; the spectroscope became a spectrometer. It was found that most of the spectral lines lie out of the visible range of light in the ultra violet part of the spectrum. But prism and lenses had to be manufactured from quartz, because glass absorbs UV-radiation. Radiation with a wavelength below 200nm is absorbed by air. To facilitate an observation of the spectrums in this range, the spectrometer has to be evacuated and the radiation has to be transmitted from the light source to the spectrograph through an inert gas (e.g. argon).

By means of the introduction of photography into the spectral analysis and the photometric evaluation on photographic characteristics (density curves), the way was smoothed for a reliable, quantitative analysis. Especially Walter Gerlach should be mentioned, who found in 1930 the following correlation: On a quantitative analysis the intensity ratio between two spectral lines of two different elements is representable as a function of the concentration ratio of the two elements. This sentence is still valid up to now.

Generally light propagates linearly. In case a light beam is limited by an opening which is of a diameter similar to the wavelength of the light, the phenomena of light diffraction occurs; behind the opening the light propagates diffusely, the opening becomes the center of an elementary wave. In case there are two identical openings side by side, two elementary waves occur interfering each other. Two waves intensify each other provided that a wave crest of the first elementary wave meets a wave crest of the second elementary wave. But if a wave crest of the first elementary wave meets a wave trough of the second elementary wave, the two waves neutralize each other. This results into the strange effect that light plus light generates darkness under particular circumstances. Instead of circular openings a light beam may be limited by very narrow slits. In case a very big number of narrow slits are positioned in identical distances, an optical diffraction grating is manufactured. In 1821 the German Joseph von Fraunhofer machined the first diffraction grating scribing parallel grooves on a glass plate (300 grooves per mm). By means of such a grating it was possible to measure the absolute wavelength of spectral lines for the first time. The Fraunhofer grating is a transmission grating. Today almost exclusively reflection gratings are used, which are manufactured by scribing grooves on a reflector. Gratings with 3600 grooves per mm may be produced today (currently also by means of a holographic procedure). Whilst in a prism short waved radiation is deflected stronger than long waved radiation, a grating performs the opposite, the radiation is deflected the more the longer the wavelength is. To project the slit in a spectrograph with a plane grating, concave reflectors are used.

The American Henry Augustus Rowland succeeded in making a great finding in 1882. He found that a grating scribed on a concave reflector may perform both, to disperse light and to project a slit. Grating and slit are positioned on the periphery of a circle (Rowland circle), whose diameter is identical to the bend radius of the grating; the slit projections (spectral lines) arise on the periphery of the Rowland circle too. The grating represents the only optical element in the spectral device. The meaning of Rowland's findings may be estimated by the fact that nowadays almost only concave gratings are used in the area of emission spectral analysis. Up to the middle of the 20th century prism spectrographs (in Europe) were prevalent; gratings were expensive and of relative low light transmitting power, compared to prisms. The development of copied gratings decreased the price of gratings drastically, and the gratings improved the light transmitting power by blazing, i.e. the grooves were profiled in a certain way. Nowadays the use of prism spectral devices is a rarity.

The analysis precision achieved by photographic - photometric methods is often not sufficient. Additionally the photographic process consumes much time (developing, fixing, washing, drying the film). The development of the photomultiplier after the second world war marks a milestone in the history of spectral analysis. A photomultiplier amplifies the photo current, generated in a photocathode, 1.0 by 100.0 times. When a spectral line meets the photocathode, an amplified photocurrent is generated at the outlet of the multiplier, which charges a capacitor to a definite voltage within a few seconds.

Spectral devices, which measure the light of the spectral lines using photomultipliers, are named spectrometers. Whilst spectrographs are universally applicable, spectrometers are tailored for a specific application decided in advance, e.g. analysis of steel. Suitable spectral lines (so called analysis lines) are selected from the spectrums of all elements to be analyzed by means of the spectrometer. Acc. to the grating formula (a formula describing the deflection on the grating depending on the wavelengths) the positions on the Rowland circle are calculated, where the selected analysis lines will appear. These positions are equipped with narrow exit slits, allowing only the analysis lines to pass through. Behind each exit slit a multiplier is positioned. The photocurrents charge the capacitors. The capacitor voltages represent the spectrometric measure values, which are transformed into analysis results by means of more or less complex analysis functions. This evaluation had been performed almost manually up to the 60es.

By means of a spectrometer it was already possible in the 60es to analyze more than 12 elements of a steel sample within about two minutes. The revolutionary short analysis period arose the interest of the metal producers like steel-, copper-, aluminum works. Both, the short analysis time during melting of a metallic material and the good reliability on the analysis results achieved, caused a complete modification of the metallurgical processes in the past 20 years.

In the beginning spectrometer systems were very expensive and used in the lab's of big companies exclusively. Due to the fast development in the area of solid-state electronics, the components belonging to a spectrometer system became smaller, better and considerably cheaper; this is why spectrometers were more and more used in medium and small sized companies. Remarkably is the development of small, mobile spectrometers during the 70es, which were used for fast material identification on the job. The identification of a material takes less than 5 seconds.

The recent big step on further development of the optical emission spectrometers was the application of computers. Starting in the middle of the 60es, computers were used to import spectrometric measure values and to transform them into analysis results. By means of this the analysis time is decreased. The most important factor is that the human being is excluded from the evaluation. Wrong analyses caused by human mistakes during evaluation (this was often the case) are no longer possible. Computers have become smaller, more powerful, cheaper, consequently their use in the spectral analysis grew steadily. Besides import and evaluation of measured values, computers are used for control and constant monitoring of the spectrometer system as well as for transmission of analysis results to various data stations. Today's spectrometers are not operated without computers.

The most current development concern the manipulations to be effected during an analysis. Feeding the samples, preparing the samples is transferred more and more to computer controlled robotics. Today there are fully-automated laboratories which are built in containers and may be positioned directly besides big melting units. Personnel is limited to maintenance operations.

See:

System Description

4.2 Evaluation of Measure Results

As described above (Optical Emission Spectrometry), at the end of the measure cycle the value of the respective radiation which is emitted by an element in the sample is measured. This measure value depends on the amount of light passing through the slit. The amount of light itself depends on the concentration of this element in the sample. Consequently it is possible to carry out a quantitative determination of an element.

A sample to be analyzed by a stationary metal analyzer shall be electrically conductive, most of the time metallic samples are to be investigated. The sample is put on the Spark Stand and an electrical arc is ignited between the sample and an Electrode. The arc vapors some sample material. The vapor contains all the elements the sample consists of. The atoms are excited to emit their spectral lines. This radiation is transmitted to the entrance slit of the spectrometer by means of lenses or optical fibers.

The higher the concentration of an element in the sample, the more intensive is the emission of spectral lines of this element; the higher the light current on the photocathode of the respective multiplier, the higher is the voltage charged on a capacitor during the measure cycle. This voltage alone is no suitable measure on concentration of an element in the sample. During evaluation the measure conditions as well as possible interferences between the elements have to be taken into account.

To perform an evaluation, note the following items:

- ➔ Analysis Function
- ➔ Calculation of Concentrations
- ➔ Interferences during Measurement
- ➔ Standardize the Spectrometer

See:

System Description

4.2.1 Analysis Function

A metallic sample consists of a base element G and the alloying elements L1, L2, L3 etc. E.g. in a steel sample the iron represents the base element, alloying elements are C, Si, Mn, Cr etc. The concentrations of the single elements are C(G), C(L1), C(L2), C(L3) etc. The spectral line I(G) is measured on the base element, the alloying elements provide the analysis lines I(L1), I(L2), I(L3) etc.

The measure values received are proportional to the intensities of the respective spectral lines; they are named by the symbol I and are simply called 'intensities'. Temporal changes of proportional factors are considered during recalibration. The basic statement on a quantitative emission analysis is:

The concentration ratio of an alloying element to the base element is a function of the intensity ratio of the respective analysis line to the base element line.

$$C(L) / C(G) = f (I(L) / I(G))$$

Measurements apply to the base element as standard, this is called an analysis procedure with inner standard. Concentration ratios are figures smaller than 1 (including some exceptions). E.g. C(L) = 2% and C(G) = 80%, the concentration ratio is 0,025. This is why the concentration ratios are 100 times higher in practice:

$$k(L) = 100 * C(L) / C(G)$$

With $C(L) = 2\%$ and $C(G) = 80\%$, is $k(L) = 2,5$. The analysis functions are given as power function. In the range of low concentrations (below 1%) the function is almost linearly:

$$k(L) = a(0) + a(1) * (I(L) / I(G))$$

For middle and high concentrations a square function is used:

$$k(L) = a(0) + a(1) * (I(L) / I(G)) + a(2) * (I(L) / I(G))^2$$

Sometimes a cubic solution trial may be necessary:

$$k(L) = a(0) + a(1) * (I(L) / I(G)) + a(2) * (I(L) / I(G))^2 + a(3) * (I(L) / I(G))^3$$

During calibration, very carefully analyzed samples, the **Calibration Samples**, are measured. Based on the known k -values of these samples in combination with the measured $I(L) / I(G)$ -values, a regression program calculates and stores the coefficients $a(0)$, $a(1)$, $a(2)$ and $a(3)$ for the analysis function.

During an analysis the k -values of the single elements are calculated, using the measure values and the corresponding analysis function. Now the k -values have to be transformed into concentrations.

Further informations can be seen under Calculation Steps

See:

Evaluation of Measurements
System Description

4.2.2 Calculation of Concentrations

Provided that concentrations are given in %, the sum of all concentrations of any elements in the sample is 100%,

$$C(G) + C(L1) + C(L2) + \dots = C(G) + \text{sum}(C(L)) = 100\%$$

Dividing this equation by $C(G)$ gives:

$$1 + \text{sum}(C(L) / C(G)) = 100 / C(G)$$

Multiplying both sides of the equation by 100, then will

$$100 + \text{sum}(k(L)) = 100 * 100 / C(G)$$

and

$$C(G) / 100 = 100 / (100 + \text{sum}(k(L)))$$

Because of $k(L) = 100 * C(L) / C(G)$ and $C(L) = k(L) * C(G) / 100$, now comes

$$C(L) = k(L) * 100 / (100 + \text{sum}(k(L)))$$

Now a calculation example on transformation of $k(L)$ to $C(L)$ is given:

A sample containing iron as base element and the alloy elements C, Si, Mn, Cr, Ni provides e.g. the following result based on the analysis function during an analysis

$$k(C) = 0,41; k(Si) = 2,60; k(Mn) = 0,47; k(Cr) = 1,27 \text{ and } k(Ni) = 1,06$$

Consequently $100 + \text{sum}(k(L)) = 105,81$ and that means $C(Fe) / 100 = 0,945$. The concentrations of the single elements are:

$C(C)$	$= 0,41 * 0,945$	$= 0,39\%$
$C(Si)$	$= 2,60 * 0,945$	$= 2,46\%$
$C(Mn)$	$= 0,47 * 0,945$	$= 0,44\%$
$C(Cr)$	$= 1,27 * 0,945$	$= 1,20\%$
$C(Ni)$	$= 1,06 * 0,945$	$= 1,00\%$

The sum of the concentrations of all elements in this example is 99.99%. The minor deviation to 100% results from rounding to two fractional digits. The analysis procedure with an inner standard (reference) prerequisites a determination of all elements in the sample basically (complete analysis). By means of this procedure it is not possible to determine just one element, e.g. Mn or Ni in a base of iron. Another requirement is that all elements in a sample are determined through concentration and intensity ratios. But analyzing steel the elements S and P are determined via absolute intensities, e.g.

$$C(S) = a(0,S) + a(1,S) * I(S)$$

In that case replace the figure 100 by $100 - C(S) - C(P)$ in the dividend during calculation. With the exception of machining steels which are alloyed by sulfur to obtain better machining properties on automatic turning lathes, the sum of the concentrations on S and P is almost below 0.01%. The figure 100 would be replaced by the figure 99.99%. If this correlation is not taken into account, just a neglectable, small mistake will be generated.

For further information please refer to Calculation Steps.

See:

Evaluation of Measurements
System Description

4.2.3 Interferences during Measurement

Measurements may be affected by interferences. The most important effects are coincidence interference and matrix effect.

Coincidence Interference

Due to the abundance of lines of some elements (Mn, Cr, Fe, Co, Ni etc.) sometimes it cannot be avoided that an analysis line lies too close to the spectral line of another element in the sample; in this case the spectral device may not separate the two lines completely. Consequently a too high intensity ratio may be measured. The interference may be eliminated by subtracting an amount from the measured intensity ratio, which depends on the concentration of the interfering element (additive correction).

Matrix Effect

In a sample series with a constant concentration ratio $c(L1) / C(G)$, the intensity ratio $I(L1) / I(G)$ should be independent from a third element L2. Unfortunately this is not always the case. The element L2 may change the intensity ratio $I(L1) / I(G)$. This is the matrix effect or the influence of third parties. An interference caused in this way is eliminated by multiplying the measured intensity ratio by a factor which depends on the concentration of the interfering element (multiplicative correction).

Since no information about concentrations of interfering elements are available before an analysis, the calculation is done based on the measured values without taking interferences into account. With that, approximated analysis results are obtained. By means of the concentrations determined in this first run the interfering factors are calculated in a second run, together with the correction of the respective values. This iterative procedure provides improved analysis results.

See:

Evaluation of Measure Results
System Description

4.2.4 Standardization of the Spectrometer

Spectrometric measure values are subject to temporal changes by many influences. To keep a spectrometer in the same state, the spectrometer was at the time of the calibration, it is necessary to standardize it at regular intervals. In the channel on the element L, the read-out measure value:

$$m'(L) = I(L) / I(G)$$

is transformed by

$$m(L) = a(0) + a(1) * m'(L)$$

to the standardized measure value. As many different coefficients $a(0)$ and $a(1)$ belong to a spectrometer, as it is equipped with different measure channels. To standardize a channel 2 standardization samples are necessary, a high sample and a low sample. Highest demands are made on the standardization samples with view to absence of cracks etc., because an analysis result is as good as the standardization, and a standardization is as good as the quality of the standardization sample. The exact chemical composition of the standardization samples has not to be known. A high sample is selected in a way that the measure result obtained is close to the upper concentration limit of the respective channel. A low sample is selected in a way that the measure results are as low as possible. In a procedure to analyze steel a sample of technically pure iron is well suited to be used as low sample. High samples should be suitable to standardize several channels. But the idea to work with just 2 standardization samples may to not be realized too often.

In the following example the standardized measure value of a high sample is named H, the read-out measure value of the standardization h. The standardized measure value of the low sample is named T, the read-out measure value is named t. The same equation system is used on both standardization samples:

$$H = a(0) + a(1) * h$$

$$T = a(0) + a(1) * t$$

with the solutions:

$$a(0) = (T * h - H * t) / (h - t)$$

and

$$a(1) = (H - T) / (h - t)$$

During calibration $a(0) = 0$ and $a(1) = 1$ are set, i.e. in the beginning is

$$H = h \text{ and } T = t$$

In case something on the channel has changed after a time, some modified values on $a(0)$ and $a(1)$, deviating from 0 and 1, are obtained.

See:

Evaluation of Measure Results
System Description
Carry out a Standardization

4.3 How the Stationary Metal Analyzer Works

The Stationary Metal Analyzer is constructed in a modular manner. All components are easily accessible, making the instrument very easy to maintain and service. The side and back panels of the spectrometer are fastened with quick-connectors. The spark stand and sample clamp are located at the front of the instrument. The rear of the instrument includes the main power switch, the power and argon connections, switches for instrument accessories, and air exhaust vents.

The Stationary Metal Analyzer can be outfitted with a maximum of 128 analytical channels. The actual number of existing channels depends on the optic(s) installed in each particular instrument. With side panels off, the UV Optic can be seen located in the upper part of the instrument and the Air Optics are at the bottom. The instrument can contain up to three air optics. Each optic has a profile adjustment dial for reprofiling.

The following Stationary Metal Analyzer component modules are of primary importance for the instrument operation:

- ➔ The Air Optics
- ➔ The UV Optic
- ➔ The Spark Stand
- ➔ The Sample Clamp
- ➔ The Spark Source

See:

System Description

4.3.1 Air Optics

The air optics are located in the bottom part of the instrument. They are visible when the side walls are opened. The air optics are built up acc. to the Paschen-Runge-Design. Due to the particular SPECTRO manufacturing method no further temperature stabilization is necessary between -10 and +30°C. All components of the optics are secured by means of special screws, which are not susceptible to shocks up to 20g.

The diameter of the Rowland circle is 750 mm and permits a efficient and compact build-up. The holographic grating can have 1800 to 3600 lines per mm, depending on the wavelength range. By means of this an average dispersion of 0.37 by 0.78 nm/mm is achieved in first order. The usable wavelength range lies between 2120 and 800 nm, provided that an optical quartz fiber is used. Shorter wavelengths are not transmitted through the optical fiber, because quartz absorbs short wavelengths.

The optical system acc. to the Paschen-Runge-Design consists of an A-frame, where the entrance slit, the grating, exit slit, photomultiplier are positioned. The light is transmitted by the optical fiber from the spark stand to the entrance slit. The entrance slit focuses the light onto the grating, which refracts the light into its single wavelengths. The exit slits on the Rowland circle are positioned in such a way that exclusively light of a definite wavelength may pass the slit. Behind each exit slit a photomultiplier is positioned which transforms the incoming light into a current. This current is proportional to the intensity of the incoming light.

See:

System Description
Mode of Operation
UV Optic

4.3.2 UV Optic

The UV optic is located in the upper part of the instrument housing and is connected directly to the spark stand. Its construction is similar to that of the air optics. However, in order to measure wavelengths below 200 nm, for example C, P, S, or B, an air-free environment is necessary. For this reason the UV optic is filled with nitrogen gas.

The nitrogen is circulated through the optic enclosure and a gas filter by a membrane pump. This pump is located on the right side of the instrument. The gas filter system removes oxygen and water vapor from the nitrogen. This contamination may have penetrated the system through a leakage or during filling the UV-tank. The nitrogen cleaning uses cartridges filled with "Oxisorb" to remove oxygen and "Hydrosorb" to remove water vapor mainly. The closed gas system provides a maintenance free atmosphere which transmits wavelengths down to 120 nm, depending on the atmosphere used.

See:

- System Description
- Mode of Operation
- Air Optics

4.3.3 Spark Stand

The spark stand is used to hold the samples to be measured. Within the spark stand box there is the argon flushed spark stand, consisting of a massive brass block making a water cooling unnecessary. The argon flush provides an oxygen free atmosphere which is necessary to obtain a pure spark excitation and to transmit wavelengths below 200 nm. A constant Argon Flow prevents polluting the spark stand atmosphere. There are three kinds of argon flow to be distinguished:

Low Argon Flow

The low argon flow is switched on when the source generator is switched off. This flow ensures an oxygen free environment and permits a fast restart of the system at any time, even if the system didn't work for a longer period.

Constant Argon Flow

The constant argon flow is switched on when the source generator is enabled but no measurement is currently carried out. This flow keeps the spark stand oxygen free and is used as Stand-By-Mode on the stationary metal analyzer.

Analytical Argon Flow

The analytical Argon-Flow is switched on automatically in the moment a measurement is carried out. You may switch on the analytical flow manually by means of the menu item

Argon flow in the Menu Instrument.

A hole is positioned in the middle of the spark stand plate. This opening has to be covered completely by the sample to be analyzed. To close the safety circuit, the Sample Clamp must be in contact with the sample. Below the hole the electrode holder and the Electrode are positioned. During sparking some of the material is evaporated and excited. The generated light is transmitted to the Optical Systems simultaneously, i.e. directly to the UV-Optic and through a fiber to the Air Optic.

See:

- System Description

Mode of Operation
Air Optics
UV Optic
Sample Clamp

4.3.4 Sample Clamp

The sample clamp is located above the spark stand. It is used to position the sample on the spark stand properly and to hold down the sample, closing a safety circuit. This circuit makes sure that the sample is only sparked provided that it is positioned on the spark stand correctly.

The sample clamp may be adjusted to the height of the sample by means of a screw. Loosen the big screw on the sample clamp for that and adjust the height. Then fasten the screw again.

When you start a measurement and the sample clamp is not closed, you will receive a corresponding error message. Close the sample clamp and confirm the message; now start the measurement again. The message will also be displayed if your sample is coated with a non-conductive layer, e.g. an enamel. To carry out the measurement, remove the non-conductive layer and start the measurement once again.

In case the circuit is closed for more than 30 minutes, the control computer starts a check-up routine. This routine prevents a further sparking and prompts you to move the sample clamp. Confirm this message and actuate the sample clamp. Then you may continue to carry out measurements.

See:

System Description
Mode of Operation
Spark Stand

4.3.5 Spark Source

Exciting single atoms is necessary to generate the optical emissions, the analysis of the element contents is based on. The energy supplied to the material is high enough to vaporise the material and to excite the vapor. The ignition of the spark is effected by means of a high voltage, which ionizes under low current the distance between sample and electrode, making it electrically conductive. That's why a spark shaped direct current arc discharge occurs which heats up the sample to generate light emitting metal vapor.

There are 25 to 600 DC-arc discharges per second (25 to 600 Hz). The process is described as spark- or arc-shaped, depending on the selected current amplitude and discharge time. High amplitude and short discharge time characterize the spark discharge, small amplitudes and long discharge times characterize the arc-shaped discharge. The source parameters are defined by SPECTRO during manufacture of the equipment acc. to the demands of the customer.

Spark discharges generally provide a better analytic precision on higher concentrations, arc-shaped discharges improve the detection limits and provide more precise results in the trace range. The spectral lines to be measured are selected depending on the kind of discharge. Spectral lines emitted by ionized atoms are used on spark discharges. Spectral lines emitted by atoms on normal energy level are used for arc-shaped discharges.

Note:

Contamination of the spark stand or argon supply by air, water vapor, or solvents affects the electrical spark and can lead to incorrect analytical results.

See:

System Description
Mode of Operation
Spark Stand

5 Technical Data

The following information is important for the installation and use of the spectrometer:

- ➔ Instrument Installation
- ➔ Electrical Source
- ➔ Argon Supply
- ➔ Sample Preparation Equipment
- ➔ Calibration and Standardization Samples

Summary of technical data:

Electrical Requirements:

Voltage	V	= 230 VAC ± 10%
Frequency	F	= 50 Hz
Power	P	= 1.2 kVA maximum = 0.16 kVA in ready-mode
Breaker/Fuse	I	= 16 A

Argon Supply:

Quality	4.8 or 4.8 + 2% H ₂
Flow	Approx. 300 l/h maximum Approx. 20 l/h with source on Approx. 10 l/h with source off

Environmental Conditions:

Temperature	minimum 6° C (about 43° F) maximum 40° C (about 104° F)
Humidity	20 - 80%

Dimensions:

Height	1420 mm	(about 60")
Width	755 mm	(about 30")
Depth	1300 mm	(about 51")
Weight	400 kg	(about 880 lbs.)

5.1 Instrument Installation

The instrument must be accessible for maintenance. The rear of the instrument should be at least 0.5 meters from the wall (1 meter is suggested). The space required by the spectrometer is about 1.5 by 0.8 meters. A place for the argon supply and printer is necessary next to the stationary metal analyzer. The sample preparation equipment should be nearby. The minimum laboratory space, without sample preparation equipment, is about five square m. Electrical and argon connections are located at the rear of the instrument.

Temperature control of the laboratory is not necessary. The design of the optical and electronic modules compensates for the effects of temperature changes. However, the irregular heating of one side or the other, for example from sunlight or room heating, must be avoided.

See:

Technical Data

5.2 Electrical Source

The SPECTROLAB requires a 230 VAC \pm 10% 50 Hz electrical supply. The electrical service should be breakered at 16 A. The main power connection is located at the rear of the instrument. Power distribution for the printer and computer is integrated in the instrument so that no additional outlets are necessary.

Please note that sample preparation equipment often requires three-phase 400 VAC, 50 Hz. This must also be considered for the installation.

See:

Technical Data

5.3 Argon Supply

1 bar = 14.50 psi

The Spark Stand of the SPECTROLAB requires **spectrometer quality argon** (4.8 = 99.998% argon) or, for certain applications, an **argon-hydrogen** mixture (4.8 argon with 2% H₂).

An argon source must be supplied by the user. Normally, this consists of a 50 liter bottle at a pressure of 200 bar. An appropriate pressure regulator (200 bar to between zero and 10 bar) is also necessary. The argon connection to the instrument is made by using the copper tubing supplied by SPECTRO (Diameter 6 mm, Length 3 m). The pressure necessary at the instrument inlet is 3 bar.

Note:

Impure argon or argon contamination between the bottle and the spark stand of the instrument can greatly influence the analytical results.

See:

Technical Data

5.4 Sample Preparation Equipment

Spectrochemical analyses demand a careful sample preparation. The nature of this preparation is dependent upon the material to be analyzed.

For the analysis of steel a grinder using 60 grit (aluminum oxide) paper is suggested. Cast iron sample can best be prepared using a swing grinder. Copper and aluminum samples should be turned on a lathe or milled.

See:

Technical Data

5.5 Calibration and Standardization Samples

The Analytical Program(s) of the instrument were agreed upon during the sales process. The instrument has been calibrated using international standards in accordance with your requirements. Should the user wish to extend this calibration or add further Analytical Programs, additional standards will be required. Please feel free to contact SPECTRO for assistance in acquiring such standards.

Standardization samples are necessary for the routine operation of the spectrometer. SPECTRO provides an appropriate set of these samples with the instrument for each matrix calibrated. It is possible, however, that you may want to use production samples for standardization.

See:

Technical Data

6 Maintenance

Routine maintenance is important for the continued day-to-day correct operation of the stationary metal analyzer arc/spark spectrometer. The primary maintenance tasks of the operator involve instrument cleaning and visual inspection. For additional help please call the SPECTRO Service Department.

Suggested maintenance intervals are as follows:

- ➔ Daily Maintenance
 - ◆ Check Argon Supply
 - ◆ Check Burn-Spot Quality
 - ◆ Standardization
 - ◆ Spark Stand Cleaning
- ➔ Monthly Maintenance
 - ◆ Replace Electrode
 - ◆ Clean Argon exhaust
 - ◆ Change Water
 - ◆ Completely Clean Spark Stand
- ➔ Bi-annual Maintenance
 - ◆ Clean Inside of the Instrument
 - ◆ Clean Air Filters
- ➔ Additional Maintenance
 - ◆ Clean Quartz Window
 - ◆ Check the Profile
 - ◆ Change Oxiclear Filter
 - ◆ Replace Standardization Samples
 - ◆ Back-up Analytical Data

6.1 Daily Maintenance

The following should be performed daily:

- ➔ Check Argon Supply
- ➔ Check Burn-Spot
- ➔ Standardization
- ➔ Clean the Spark Stand

See:

Maintenance

6.1.1 Check Argon Supply

Before starting the instrument by pressing the <Standby> switch located at the back of the spectrometer, the argon supply should be checked. Problems with the spark source may occur if the instrument is used without a sufficient argon supply.

Check the supply gauge of the argon regulator. The argon bottle should show a pressure of at least 10 bar. If a lower pressure is indicated, change the argon bottle. More detailed information can be obtained from your argon supplier.

During use the "Instrument Status" line located at the bottom of the Measure Window should be checked periodically. When the argon supply is no longer sufficient for proper instrument operation, a message to this effect will appear.

After changing the argon bottle, flushing the system for about two minutes under analytical Argon Flow is recommended. In the Measure Window select the Instrument Menu and choose the option "Argon Flow" to turn this analytical flow on or off.

Note that oxygen or water vapor in the argon atmosphere lead to bad burns and therefore to incorrect analytical results.

Contamination of the argon atmosphere can be due to the following:

- ➔ Contaminated argon
- ➔ Leaks in the argon system, primarily between the sample and the spark stand.
- ➔ Sample condensate produced during sparking.

See:

- Maintenance
- Daily Maintenance
- Spark Stand

6.1.2 Checking the Burn-Spot

The sparking process consists of a prespark time and a spark or integration period. The prespark consists of a burn-in time and a sample homogenization period. During the high energy prespark the sample surface is homogenized in the inert argon atmosphere. This eliminates the majority of effects, due to the metallurgical state of the sample, which can influence the spectrochemical analysis.

Inclusions in the sample are attacked during the burn-in period. This results in diffuse (scattered, low-energy) sparks due to the lower plasma temperature. This is evidenced by shallow, white burn-spots and very low measured element intensities. When all sample inclusions have been removed, the measured element intensities increase to their maximum value. The time necessary for this burn-in process to occur varies depending on sample type and quality.

Concentrated (energetic) discharges are produced during the homogenization period. The sample surface is effectively remelted point by point and this is evidenced by a shiny metallic surface with a homogeneous (micro)crater distribution. A black condensate is deposited around the burn-spot. At the end of the homogenization period the sample sparking process has reached a steady state. Material from deeper levels of the sample is added (to the plasma) and an equilibrium is established between the already vaporized material and the additionally ablated (removed) sample material. The homogeneous layer is greater than the dimensions of the inclusions. The actual measurement cycle (integration) can now begin. Note that the sample excitation parameters are chosen so that the pre-spark time is kept as short as possible.

Oxygen in the argon system can lead to the production of oxides. This results in diffuse sparks with white burn-spots. Little or no sample ablation (removal) occurs and low intensities for the elements are the result. The optimal burn-spot is dependent upon several factors, including the excitation source frequency, integration parameters, and the sample type and can vary from system to system. It is important that the difference between good and bad burn spots is made clear during the instrument installation.

When confronted with bad burn-spots, check the following:

- ➔ The Sample Preparation
- ➔ The Sample itself (Inclusions)
- ➔ The Argon Quality
- ➔ Possible Leaks in the Argon system

See:

Maintenance
Daily Maintenance
Spark Stand
Check Argon Supply

6.1.3 Standardization

The nature and frequency of instrument standardization depends upon the sample throughput and the system itself. For this reason it is impossible to provide an exact time period between successive standardizations. One can, for example, configure the system such that each new shift begins by standardizing the spectrometer. The instrument should certainly, however, be standardized after changes have been made to the system, such as maintenance or service work! Control samples may be used to prevent unnecessary standardization.

Notes:

Using Dialog Box Mode & Intervals the software can be configured in such a way that instrument standardization is automatically required after a given time or number of sparks.

Standardization is part of the Routine Operation of the instrument.

See:

Maintenance
Daily Maintenance
Measure Window
Dialog Box Standardization
Dialog Box Control Sample Test

6.1.4 Spark Stand Cleaning

During the sample sparking process a (black) deposit of sample condensate forms in the Spark Stand. This metallic condensate can result in electrical conduction ("spark over") between the electrode and the spark stand. To prevent sparkovers the electrode shall be cleaned regularly (after each measurement as a rule) by means of a brush.

To clean the inside of the spark stand, follow the steps given below:

- ◆ Shut off the argon flow.

- ◆ Remove (unscrew) the electrode gapping tool at the front of the spark stand.
- ◆ Remove the spark stand cover by lifting and pulling away.
- ◆ Remove the four screws securing the spark stand top-plate.
- ◆ Clean the spark stand with a suitable portable vacuum cleaner.
- ◆ Remove the glass insert and clean with a rag or paper towel.
- ◆ Replace the glass insert and the spark stand top-plate.
- ◆ Re-set the analytical gap (the distance between the tip of the electrode and the bottom of the sample) by using the electrode gapping tool and the allen wrench provided.
- ◆ Turn on the argon flow.

Note:

During cleaning after each measurement make sure that the brush does not touch the spark stand and the fixture device at the same time.

The amount of condensate deposited in the spark stand depends on several factors, for example, the number of sparks and the kind of metal being analyzed. Therefore, the required cleaning intervals may vary.

Using the Parameter Data Files the system can be configured so that the user is required to clean the spark stand after a given number of sparks.

The fine metallic dust removed by the vacuum cleaner is sometimes combustible in air. Take care that the vacuum cleaner used is appropriate for this application. Otherwise a small fire may result.

The vacuum cleaner should not be held directly over the argon exhaust as otherwise water, from the bottle below, may be sucked up into the spark stand.

Ensure that the large O-ring at the bottom of the spark stand top plate is properly seated to prevent air from entering the spark stand.

See:

Maintenance
Daily Maintenance
Spark Stand
Menu Item Argon Flow

6.2 Monthly Maintenance

The following should be performed on a monthly basis:

- ✓ Replace the Electrode
- ✓ Clean the Argon Exhaust
- ✓ Change the Water
- ✓ Completely Clean the Spark Stand

See:

Maintenance

6.2.1 Replacing the Electrode

The sparking process not only removes sample material but also produces some wear on the electrode. Therefore it is necessary to periodically replace the electrode. Depending on sample load, this should normally be done on a monthly basis.

The electrode is fastened in place inside its copper heat sink by a small set-screw. To release this screw, remove the electrode gapping tool which screws in place at the front of the spark stand. Insert the allen wrench provided into the opening until it fits into the head of the set-screw. Slowly loosen (but do not remove) this screw until the electrode "pops up." Do this carefully as the electrode is spring-loaded, that is, it sits on a small spring. Hold a finger slightly above the spark stand opening so that when the screw has been loosened sufficiently the electrode will push against your finger and can then be removed.

Place the new electrode into the opening of the copper heat sink and turn the set-screw just enough to hold it in place. Set the electrode gapping tool on top of the electrode, release the set-screw, and push down until the tool is flush with the top of the spark stand. Now tighten the set-screw to fasten the new electrode firmly into its proper position. Replace the electrode gapping tool in its place at the front of the spark stand.

Notes:

The electrode should be cleaned regularly with the small wire brush provided. Normally this is done after every sample.

Both ends of the electrodes can be used.

Electrodes with severe sample deposits can be cleaned using a weak acid bath.

Used electrodes with a rounded tip can be re-machined to again provide a 90° angle.

See:

Maintenance

Monthly Maintenance

Spark Stand

6.2.2 Cleaning the Argon Exhaust

The argon exhaust is the outlet for the argon used to flush the spark stand. The outlet is connected to a bottle of water and may be deposited, choked or partly clogged by the same condensate which is deposited in the spark stand too. The choking of the argon outlet depends mainly on the number of samples per period and on the kind of samples to be measured.

The argon exhaust is best cleaned by two people. One person takes the hose out of the water bottle, closing the outlet with a thumb or a suitable cork. The second person switches on the Argon-Flow in the Menu Item Argon Flow, closing the spark stand opening by means of a thumb or something else. The first person should keep the tip of the hose into a suitable collecting receptacle (plastic bag, paper bin) and remove the thumb from the outlet; the argon under pressure will escape taking the condensate out of the hose.

When you are alone, take out the hose out of the water bottle and fix it into a suitable collecting receptacle. Remove the hose from the spark stand and switch the vacuum cleaner to 'blow'. Use the vacuum cleaner properly to blow out the condensate of the hose.

Note:

After cleaning, the tip of the hose has to be positioned below the water surface. So a penetration of oxygen into the spark stand will be avoided.

During cleaning a big amount of condensate may be blown out of the hose. Always use a proper receptacle!

You must not try to vacuum the condensate by means of a vacuum cleaner. Water may penetrate the spark stand!

See:

Maintenance
Monthly Maintenance
Spark Stand

6.2.3 Changing the Water

The water bottles are located underneath the spark stand. The first bottle should always be 2/3-full and the argon exhaust tube must be inserted below the water level but above the bottom of the bottle. The second bottle should only be filled with water up to a height of about 5 cm. In this case both the argon inlet and exhaust tubes should be well above the water level.

Note:

The water in the first bottle should be changed regularly, at least once a month.

See:

Maintenance
Monthly Maintenance
Spark Stand

6.2.4 Completely Cleaning the Spark Stand

The metal condensate, causing sparkovers within the spark stand, may penetrate the inner spark stand. This is why you should clean the complete spark stand once per month.

Start in the same way as standard Spark Stand Cleaning. Make sure the source generator is switched off. Then proceed in the following way:

- ◆ Remove the argon supply hose from the spark stand.
- ◆ Remove the four big screws fixing the bottom part of the spark stand in position.
- ◆ Let down this lower part (electrode, heat sink, white teflon block) and pull it a little bit to the front.
- ◆ The teflon block and the area below the teflon block may be cleaned by means of a fluff-free cloth or a vacuum cleaner.
- ◆ Remount the teflon block. Take care that the hole in the teflon block fits with the hole in the heat sink to be able to insert the allen wrench, which is necessary to loose the electrode.
- ◆ Re-assemble the bottom part of the spark stand when you are sure that all holes for the height adjustment of the Electrode are positioned in a plane. Re-insert the four big screws, the long ones behind, the short ones in front.
- ◆ Re-connect the hose of the argon outlet and the spark stand.
- ◆ Assemble the spark stand plate and adjust its height as done during standard Spark Stand Cleaning.
- ◆ Switch on the argon flow for about 2 minutes to flush out the air which penetrated the

spark stand during cleaning.

Note:

You must not touch the brass heat sink the electrode is fixed in.

All connections shall be tight to avoid air penetration into the spark stand.

After cleaning you should check the Burn-Spot to make sure that all the air is removed from the system. If it is not the case, you should flush the system with the analytic Argon-Flow for a longer period to ensure a complete removal of the air. Flush the system until a proper burn spot is achieved.

See:

Maintenance
Monthly Maintenance
Spark Stand Cleaning
Spark Stand

6.3 Bi-annual Maintenance

The following maintenance checks should be performed every six months:

- ➔ Clean Inside of the Instrument
- ➔ Clean Air Filters

See:

Maintenance

6.3.1 Cleaning the Inside of the Instrument

Every six months the inside of the instrument should be cleaned. Shut off instrument power using the main power switch at the rear of the instrument. Then, the inside can be cleaned with a vacuum cleaner. The vacuum cleaner hose must not come into contact with any of the electronic components. **Do not open** the covers of the optical system(s)!

Note:

If a Maintenance/Service contract was included in the purchase of the instrument, then this cleaning will be performed as a part of this contract.

The optical system(s) can be damaged by opening the protecting covers!

See:

Maintenance
Bi-annual Maintenance

6.3.2 Cleaning the Air Filter

The air filters should be cleaned or replaced every six months. This is necessary to provide sufficient air flow for instrument cooling. The air filter mats may be removed provided that the equipment is switched off and may either be cleaned by a vacuum cleaner or washed out in a cold and mild detergent. In case the mats cannot be cleaned by means of these procedures, they shall be replaced by new ones.

Note:

When you had washed the mats let them dry completely before re-assembly.

See:

Maintenance
Bi-annual Maintenance

6.4 Additional Maintenance

-The following maintenance should be performed as necessary:

- ⇒ Clean the Quartz Window
- ⇒ Check the Profile
- ⇒ Replace the Oxiclear Filter
- ⇒ Replace the Standardization Samples
- ⇒ Back-up the Analytical Data

See:

Maintenance

6.4.1 Cleaning the Quartz Windows

As the quartz windows become dirty during the routine operation of the instrument, the measured intensities also decrease. If the intensities of one or more of the internal standard (reference) lines fall below a preset minimum, this is shown by the appearance of the "<" symbol ("less than") for the concentration of the matrix element. The quartz window(s) must be cleaned or replaced.

The windows are located at the right side of the spark stand. Only clean those windows on the spark stand side. The window(s) protecting the fiber optic connection to the optical system(s) do not normally need cleaning. The windows are held in place by a brass holder which screws onto the opposite fitting on the spark stand. Unscrew the holder, remove the window, and clean with isopropanol and optical cleaning paper.

Allow the window(s) to dry before replacing. Ensure that the small Teflon O-ring is properly seated in the brass holder. A black rubber O-Ring must be in place on the spark stand side. It functions as a seal between the spark stand und Quartz window.

Note:

Should it become necessary to clean the window covering the fiber optic, be extremely careful not to disturb the fiber optic while removing and replacing the window!

See:

Maintenance
Additional Maintenance

6.4.2 Profile Check



A small plane-parallel disk (refractor wafer) is found at the light entry into the simultaneous optics. If a light ray hits this plane-parallel disk in another angle than 90°, the light ray is displaced to the side. In the case of profile check, the refractor wafer is turned by a spindle at the entry gap of the optics in the angle of the light ray. As a result, a slip of the light ray is achieved, which can be used to align the light optimum onto the photoreceivers. This process is called Reprofiliation.

The reprofiliation is done, depending on model and equipment of your stationary metal analyser by an Allen wrench, via a handwheel or a stepping motor. The execution of a SIM Reprofiliation is described in the chapter Procedure in detail.

If your stationary metal analyzer is equipped with a Monochromator, you shall carry out a Reprofiling once per day or after each start of the instrument. The reprofiling is supported by the stepper motor of the monochromator. How to Carry out a Reprofiling for a monochromator is described in detail in section Procedure.



SPECTROLAB Jr. CCD does not contain any movable parts for profile adjustment. The reprofiliation is carried out by evaluationg the light signal at the expected peak position and its direct vicinity.

See:

Inspection
Further Inspections
Carry out a SIM Reprofiliation
Carry out a Monochromator Reprofiliation

6.4.3 Replacing the Oxiclear Cartridge

The quality of the gas-filling in the UV-optic is supervised by the analysis system. To this end the intensity ratio of two channels should regularly be checked in the UV-optic. Please used the menu items UV-Transmission Test and UV-Test, which can be found in the program development window under the menu **Instrument**. The test is performed on the fact that short-wave light is impeded stronger than long-wave light by contamination of the gas filling. The measured intensity relation of two lines with different wavelengths is stored as a set value during starting up the spectrometer. Caused by contamination within the UV-optic this relation drops down in the course of time. When the relation drops below a definite minimum value, a respective message is displayed on the screen after the standardization. Now you should replace the Oxiclear cartridge. Please proceed as described below:

- ♦ Switch off the spectrometer trough the main switch at the backside of the device and pull the mains plug.
- ♦ Remove the upper left and right side wall as well as the upper backside.
- ♦ Now you may see the big silver or black cartridge at the back of the device.
- ♦ Loosen the quick acting closures at the right and left side of the Oxiclear cartridge and pull them sideways away. The connection is solved.

- ◆ Now you can take out the old cartridge. Make a note of the replacement date and - if necessary - the serial number of the device in the label of the old cartridge.
- ◆ Make a note of the installation date and the serial number in the label of the new cartridge.
- ◆ Position the new cartridge properly and fix it with the quick acting closures. Take care that the cartridge is firmly attached to the device.
- ◆ Attach the side- and backwalls.
- ◆ Plug in the mains connector and switch on the device by means of the mains switch at the backside of the device.

Notes:

If just one channel can be used in the UV-optic, the intensity of the channel will be compared with a preset value.

You should send back the old Oxiclear cartridge to SPECTRO for recycling purposes. Please use the original packaging to avoid damaging the connections.

The necessary time to bring back the intensities to their original values depends on the contamination level of the nitrogen atmosphere and may last from 10 minutes to several hours.

See:

Inspection
Maintenance
Menu item UV-Transmission Test
Menu item UV-Test

6.4.4 Replace Standardization Samples

As soon as the standardization samples are used up, you have to replace them. SPECTRO supports you to purchase new ones. Because your new standardization samples have another composition than the old ones, the intensity values you obtain during a measure shall be adapted to the intensities of the old samples. Call-up the Dialog Box New Standardization Sample in the menu **Extras** of the program development.

See:

Maintenance
Additional Maintenance
Program Development

6.4.5 Save Analytical Data

Saving analytical data should be a routine like cleaning the spark stand. Saving all analytical data is effected by means of the Menu Extras of the program development. For further details see Data Saving.

Additionally there is the possibility to save and retrieve single analytical programs through the functions 'Program export / Program import'. You may find these functions in the Menu Extras of the program development.

See:

Dialog Box Export Program
Dialog Box Import Program
Menu Extras
Program Development
Maintenance
Additional Maintenance

7 Spectro Service

➔ **Service Extension for Germany: (x 2821) 892-3100**

With this telephone number you can contact our service department from 8.00 to 17.00 h. In case the individual extension is occupied, your call is transferred to the next free extension automatically. Out of office hours between 17.00 and 8.00 h, the extensions are on auto answer mode. Leave your number and name, your message will be handled as soon as possible and we will call you back. 24 h per day our **service telefax** is available for you (x 2821) 14126.

➔ **Spectro Service Organisation**

This chapter informs about the performance of the service, how to contact the service of your local Spectro branch, and contains a list of the most important Spectro branches and addresses.

7.1 Spectro Service Organisation

Service Extension for Germany: (02821) 892-3100, e-mail: service@spectro-ai.com

With this telephone number you can contact our service department from 8.00 to 17.00 h. In case the individual extension is occupied, your call is transferred to the next free extension automatically. Out of office hours between 17.00 and 8.00 h, the extensions are on auto answer mode. Leave your number and name, your message will be handled as soon as possible and we will call you back. 24 h per day our **service telefax** is available for you (x 2821) 14126.

In case of questions on the instrument software, we recommend you to look up your **user manual** at first or to call up the **help function**. In case the documentation is not sufficient to answer your question, please ring the service of your local Spectro branch. In case of written or verbal inquiries please provide the following data:

- ✓ The version number of your software
- ✓ The hardware used
- ✓ The precise wording of messages displayed on your screen.
- ✓ The problem itself and the current operation the problem occurred.
- ✓ How you tried to solve the problem.

The Spectro service provides you with divers and high quality technical support: Sensible maintenance contracts to ensure the stability of value and the quality ability in the long term, complete and flexible maintenance and repair capacities by means of trained personnel and fastest sending of spare parts and components, upgrade programs to retrofit and to adapt your analysis system to the current state-of-the-art, various education and training programs for users. Feel free to contact the appropriate Spectro branch for more information. The Spectro service is subject to current prices and general conditions and may be canceled without prior notice.

Spectro is present in about 50 countries worldwide. The addresses of your local partner may be received by the headquarters in Germany and the USA.

Germany SPECTRO A.I. GmbH & Co. KG
Boschstraße 10
47533 Kleve
Tel.: 2821 8920
Fax: 2821 23144

USA SPECTRO A.I. Inc.
160 Authority Drive,
Fitchburg, MA 01420
Tel.: 508 3423400
Fax: 508 3428695

France SPECTRO FRANCE S.A.R.L.
1, rue Colonel Chambonnet
69500 Lyon-Bron
Tel.: 78410133
Fax: 72370649

United Kingdom SPECTRO Analytical UK Ltd.
Fountain House
Great Cornbow
Halesowen
West Midlands
B63 3BL
Tel.: 021 5508997
Fax: 021 5505165

Italy SPECTRO Italia S.r.l.
Via Delle Querce, 11
20156 Milano
Tel.: 02 33001117
Fax: 02 33000442

Mexico SPECTRO A.I. de Mexico
S.A. de C.V.
Cerrada de Dr. Duran No. 15
Col. Doctores 06760
Mexico, D.F.
Tel.: 5 5300318
Fax: 5 5303645

8 Software Structure

The Spark Analyzer program is divided into 5 functional areas, which show each an own main window.

functional area

- ✓ Measure Window
- ✓ Sample Management
- ✓ Program Development
- ✓ Regression
- ✓ Scan Manager Monochromator, Scan Manager CCD resp.

The **Measure Window** (or **Measure Screen**) is automatically called-up after start the Spectrometer. It is the daily work space for all the Spectrometer routine work. Apart from the functionality's with the measure tasks you may carry out smaller modifications of the Analytical Program as far as they are directly related to the measurement or data output.

The **Sample Management** is a small data bank system to manage sample results which were stored from the measure window. The storage of sample results is preset by the manufacturer

The **Program Development** is used to modify the analytical programs. Her element selections and calibration ranges are defined, from here the calibration of the instrument is started. You won't need the program development very often. By means of this program, you may modify the analytical program, which is currently loaded in the measure window. Changed entries, e.g. for inquiry of sample data before analysis, have a direct influence on the measure window, with no need to store data or call-up once again the analytical program. Before you exit the Spectrometer software or reload another analytical program you are asked whether you want to store the modified entries.

The **regression window** is called-up from the program development. It is used to calculate the calibration curves based on a prior measurement of calibration curves.

The **Scan Manager Monochromator** is used to scan spectral lines in connection with a Monochromator.

The **Scan Manager CCD** is used to scan spectral lines with the SPECTROLAB Jr. CCD



User Interface under MS-Windows

Operating the Spectrometer program is done under the user interface of MS-Windows. If you are not so familiar using Windows programs, you will find more information under Operating Windows Programs . To call-up the corresponding help page, click easily on the green highlighted text of the previous sentence.

User Levels

Not all functions are available for all users. By means of stepped used levels, the unauthorized changement of program data is avoided.

There are 4 user levels. One user level is reserved for the SPECTRO Service, it is used for the entry of the hardware equipment of your Spectrometer.

The assignment of your employees to the user levels is done in the program development through the Dialog Box User ID and Passwords.

In the following a survey about the access authorization is listed:

- A. Service (access for SPECTRO Service for basic instrument settings)
- B. level 0 (supervisor; access for the person responsible for the Spectrometer)
- C. Level 1 (analyst)
- D. Level 2 (shift leader)
- E. Level 3 (worker)

	level 3	level 2	level 1	level 0
meas				
urew				
indo				
w				
menu file				
load program	X	X	X	X
program development			X	X
sample management		X	X	X
printer settings		X	X	X
printer set-up			X	X
print locally	X	X	X	X
store results	X	X	X	X
transfer results	X	X	X	X
end program	X	X	X	X
menu file	all menu items accessible			
menu measure	all menu items accessible			
menu program				
prespark time		X	X	X
output parameters		X	X	X
element format		X	X	X
standardization results	X	X	X	X
calibration ranges	X	X	X	X
menu instrument				
Argon flow	X	X	X	X
reset spark counter		X	X	X
menu extras				
output mode	X	X	X	X
options		X	X	X
Alloy Grade Library	X	X	X	X
transfer data buffer	X	X	X	X
change password	X	X	X	X
menu help	all			

program development	menu items accessible	
	all menu items accessible	
menu file	all menu items accessible	
menu edit	all menu items accessible	
menu installation		
installation	X	X
optics		
diagnosis, logbook	X	X
diagnosis, ICS-access		
diagnosis, spion	X	X
initialize	X	X
UV-check	X	X
menu extras	all menu items accessible	
menu help	all menu items accessible	

9 Measure Window

The Measure Window is used for measurements of Production Samples and for additional Standardization of the instrument. During Calibration it is used to measure Calibration Samples additionally. In case the Measure Window is called up, the following menus are displayed:

- ➔ Menu File
- ➔ Menu Edit
- ➔ Menu Measurement
- ➔ Menu Program
- ➔ Menu Instrument
- ➔ Menu Extras
- ➔ Menu Help

Below the menu bar the fields on sample identification are displayed in a gray bar, if requested. The fields are defined in the menu Program Development through the Dialog Box Sample ID Format. Below this bar the actual Measure Window is positioned, where the elements and/or channels of the loaded program are displayed. Depending on the number of elements the bars are displayed with element symbols and channel names respectively. In case there are too many elements which cannot all be displayed at the same time, you can page by means of the scroll bar on the right margin of the screen. If measure values are displayed, there will be scroll bars positioned besides the values to page up and down through the measure values. You may use the arrow keys alternatively. The display of measure values may be effected in the following kinds:

- 0.0663 regular result output, the calculated value is displayed
- <0.0015 below low limit, the low limit is displayed
- ~0.1473 above high limit (1.0-1.2 times), the calculated value is displayed
- >1.231 above high limit (>1.2 times), the high limit is displayed

Usually the calculated concentrations are displayed in the result output. By means of the Menu Item Output Mode in the Menu Extras you may also display the raw intensities and intermediate results respectively. You may switch between the various output modes by means of <+> and <-> keys in the numeric keypad. The display will be updated, if necessary a switch over to the channel display will be effected.

Additionally you may control by means of the menu items **Single values, Average, Average and RSD** in the Menu Edit the values to be displayed in the result output. The respective symbols in front of the rows on the results are changed. The symbols mean:

- 3 number of the respective measurement, single value display
- \bar{x} average of all single measurements, average and average & RSD resp. display
- $\bar{\uparrow}$ outer high limit, average and average & RSD resp. display, values are displayed in case of a control sample test or during alloy grade monitoring
- $\bar{\uparrow}$ inner high limit, average value display, values are displayed in case of a control sample test or during alloy grade monitoring
- \downarrow inner low limit, average value display, values are displayed in case of a control sample test or during alloy grade monitoring
- \pm outer low limit, average and average & RSD resp. display, values are displayed in case of a control sample test or during alloy grade monitoring

- s absolute standard deviation, average & RSD display
- $s\%$ relative standard deviation, average & RSD display

Down at the bottom of the window the status line is displayed. The status line informs you about the status of program and hardware control. The following boxes are displayed:

- ➔ status of program
e.g. during a multi-measurement the currently proceeded single measurement is displayed
- ➔ status of Instrument-Controller
e.g. the currently used optics are displayed, additionally error messages may be given, e.g. sample clamp open or source switched off
- ➔ status of argon flush
If there is no display, the argon flow is switched off. During argon flow a 'F' is displayed.
- ➔ reading of spark counter (software)
The number of sparks since the last reset of the spark counter is displayed.
- ➔ name of the loaded analytical program

Above the status line the symbol bar is displayed. You may use it to call up definite functions of the program directly by clicking the respective icon or pushing the respective button. The following symbols and buttons are available:



Click this icon or press the <F1> key to call up the context sensitive help function.



Click this icon or press the <F2> key to Start Measurement.



Click this icon or press the <F3> key to Stop Measurement currently running. This may be necessary in case e.g. you recognize a sample not positioned correctly (increased noise during sparking).



Click this icon or press the <F4> key to display Single Value Average and the inner and outer concentration limits if necessary.



Click this icon or press the <F5> key to display Single Value Average, Associated Statistical Characteristics (absolute and relative standard deviation) and concentration limits.



Click this icon or press the <F6> key to display Single Values of Measurements.



Click this icon or press the <F7> key to start a Standardization.



Click this icon or press the <F8> key to start a Type Standardization.



Click this icon or press the <F9> key to store the results of the last measured sample and to open the Dialog Box Sample Data for the next sample.



Click this icon or press the <F10> key to open the Dialog Box Load Program and to load another analytical program.



Click this icon or press the <F11> key to start a Control Sample Test



Click this icon or press the <F12> key to start a printout on the local printer.

The partial standardization is a functionality of the measure window which is only available with automated systems (SPECTROLUX). It will not be started with a menu item.



During starting the spectrometer program of SPECTROLAB Jr. CCD and calling up the measure window, a dark current test is carried out. This test is very short and cannot be aborted. The status indication shows the ongoing dark current test.

See:

- Program Development
- Sample Management
- Scan Manager
- Carry out a Measurement

9.1 Menu File (Measure Window)

This menu is used to open and enable windows, to call up file and print operations and to exit the program. The menu is displayed in each window. Especially in Measure Window the following menu items are available:

- **Load Program**
Select this menu item to open the Dialog Box Load Program. By means of this dialog box you may load the analytic Program for the next measurements. You may enable this menu item with the button <F10> too.
- **Search Program**
Select Menu Item Search Program to search for a associated analytic program by means of a Orientation Program after a measurement. You may enable this menu item with the key combination <Shift>+<F10> too.
- **Program Development**
Select this menu item to switch over to the window on Program Development. You may enable this menu item with the key combination <Shift>+<F12> too.
- **Scan Manager**
Select this menu item to switch over to the window of Scan Manager. The scan manager is called-up as independent program part, like e.g. the program development. If you want to use the scan manager for integrating monochromator

lines into an analytical program, you may call-up the scan manager through the Dialog Box Channel Parameter in the window on Program Development. You may enable this menu item with the key combination <Ctrl>+<F12> too.



This menu item is not available for SPECTROLAB Jr. CCD.

➔ **Sample Manager**

Select this menu item to switch over to the window of the Sample Manager. You may enable this menu item with the key combination <Alt>+<F12> too.

➔ **Layout**

Select this menu item to open the Dialog Box Layout. By means of this dialog box you may preset the printout on the local printer.

➔ **Printer Setup**

Select this menu item to open the Dialog Box Printer Setup. By means of this dialog box you may define and configure resp. the local printer.

➔ **Print Local**

Select the Menu Item Print Local to start a print-out on the local printer. You may enable this menu item with the key <F12> or the key combination <Ctrl>+<P> too.

➔ **Print Remote**

Select the Menu Item Print Remote to start a print-out on the Remote Printer. You may enable this menu item with the key combination <Ctrl>+<R> too.

➔ **Store**

Select the Menu Item Store to save the measure results in an external sample file. You may enable this menu item with the key combination <Ctrl>+<S> too.

➔ **Transmit**

Select the Menu Item Transmit to transmit measure results to an external terminal. You may enable this menu item with the key combination <Ctrl>+<R> too.

➔ **Exit**

Select the Menu Item Exit to quit the program 'Spark Analyzer'. You may enable this menu item with the key combination <Alt>+<F4> too.

See:

Menu File (Program Development)
Measure Window

9.1.1 Dialog Box Load Program

This dialog box provides information for loading an Analytical Program. The dialog box is accessed via the menu item Load Program in the Menu File in the Measure Window and in the window Program Development. This dialog box includes the following elements:

Edit Field Selected Program

In this field the name of the desired Analytical Program can be directly entered. The first Analytical Program beginning with the entered characters is automatically selected. After clicking in this field it results in the display a list of all programs beginning with this character. For example, entry of an "F" in this field returns a list of all programs with names beginning with "F." After clicking to the name of a program in the list box below, the whole name is shown in this field.

List Box Available Analytical Programs and Bases

This field displays a list of all available Analytical Programs and their assigned Base Element. Behind the base element you see a short description of the analytical program. Click on a list entry to select a program. A double click not only select the program, but also close the dialog box and loads this Analytical Program.

Button OK

Clicking this button to close the dialog box and load the Analytical Program selected from the list of available programs.

Button Cancel

A click in this button closes the dialog box and no Analytical Program is loaded.

Button Print

Click this button to print the list of analytical programs.

See:

- Menu File (Measure Window)
- Measure Window
- Program Development
- Menu File (Program Development)

9.1.2 Menu Item Search Program

After a measurement with an Orientation Program, selection of this item results in the automatic search for an appropriate Analytical Program. This menu item is, however, only active if the measurement has been made in an orientation program. The Analytical Program found is automatically loaded and the measurement results recomputed. If no appropriate Analytical Program is found, this information is displayed. Using the Dialog Box Options in the Menu Extras, the automatic loading of the Analytical Program and reloading of the orientation program for the next sample may be activated.

See:

- Measure Window
- Menu File
- Dialog Box Options

9.1.3 Dialog Box Layout

This dialog box is used to define parameters on printer output. The definition of the printer is effected through the menu item Printer Setup in the Menu File. This dialog box is opened through the menu item **Layout** in the Menu File. The dialog box contains the following dialog elements:

Group Box Printer**Display Field Printer Type**

The field displays the name of the printer installed.

Display Field Port

The field displays the name of the interface the printer is connected to.

Check Box Page Printer

Mark this field in case your printer is page-oriented. That means your printer processes single-sheet paper, e.g. laser printers or most ink jet printers. If you wish to use continuous paper, you should not mark this box to make optimum use of the paper.

Check Box Default Font

Mark this field in case the print routines shall not modify the current font settings of your printer. The font set on the printer (generally Draft) is applied automatically. Marking the box the following adjustment options are disabled.

Check Box Page Optimized

Mark this field when you want to print several print-jobs without form-feeding after each job. In this case we use a DOS print-command instead of the windows print function. Note that this ability is not available on every printer. Further details can be got under Tip: Optimize Print-Output. Marking this box other adjustment options are disabled. Printing fonts can not be set.

Group Box Character Width

By means of the two combination boxes you may change the distance of the characters under each other, separately on standard and highlighted texts.

Pattern Field Header Font

The field displays a pattern of the font selected for highlighted text, e.g. for the header line.

Pattern Field Value Font

The field displays a pattern of the font selected for regular text, e.g. to display the analysis results.

Button Header Font

By means of this button you open the Windows standard dialog to select a font for the highlighted text in the header lines.

Button Value Font

By means of this button you open the Windows standard dialog to select a font for the regular texts, e.g. to display some values.

Button OK

By means of this button you shut down the dialog box. The changed settings are accepted, stored and used during the next printout for the output.

Button Cancel

By means of this button you shut down the dialog box. The modified settings are not read-in.

See:

- Menu File
- Measure Window
- Optimize Print-Output

9.1.4 Dialog Box Printer Setup

This dialog box serves to install the printer and define the output format. This dialog box is opened through the menu item Printer Setup in the Menu File. Note: Use the standard Windows printer setup procedure to add to the list of available printers. The dialog box contains the following options:

Group Box Printer

Radio Button Standard Printer

Choose this option to use the standard printer.

Radio Button Special Printers

Choose this option if a special printer is to be used. The special printer must then be selected in the combo box described immediately below.

Combo Box Select Special Printer

The special printer to be used must be chosen from the list presented in the assigned list box. If your printer does not appear in the list, then it must first be installed through Windows.

Group Box Format**Radio Button Portrait**

Choose this option to print length-wise, i.e., in portrait format.

Radio Button Landscape

Select this option to print sideways, i.e., in Landscape format.

Group Box Printer Paper**Combo Box Paper Size**

Choose the desired printer paper size through the assigned list box. Select DIN A4 format or the equivalent (for example, 8½ x 11).

Combo Box Paper Feed

Choose the desired paper feed method in this field.

Button Ok

Click on this button to close the dialog box and store the changes.

Button Cancel

This button closes the dialog box without storing any changes made.

Button Options

Choose this option to make printer-specific setups. The dialog box displayed depends on the printer selected and the installed printer driver.

Button Help

Click on this button to show the printer setup help text.

See:

- Menu File (Measure Window)
- Menu File (Program Development)
- Measure Window
- Program Development

9.1.5 Menu Item Print Local

Select this menu item to print out the measurement results shown on the screen on the local printer. This option is only active if a measurement has already been made. Using the Dialog Box Output Mode in the Menu Extras and the menu items of the Menu Measure, the screen display mode can be changed. Automatic output of the measurement results can be activated in the Program Development window using the Dialog Box Output Parameters. This menu item can be activated repeatedly for the same sample. In this way it is possible to repeat the print out in the case of, for example, a paper feed error.

See:

- Dialog Box Layout
- Dialog Box Printer Setup
- Dialog Box Output Mode

- Dialog Box Output Parameters
- Menu File
- Menu Measure
- Measure Window

9.1.6 Menu Item Print Externally

Select this menu item to output the measurement results displayed on the screen on an External Printer or a video terminal. This option is only active if a measurement has already been made and automatic data transmission has NOT been activated. Additionally external printers must have been installed. Read the [tip: ext. printers and terminals](#). The output is directly in ASCII-Format. Using the Dialog Box Output Parameters you can enable the automatic output of the measurement results.

See:

- Dialog Box Output Mode
- Dialog Box Output Parameters
- Menu File
- Menu Measure
- Measure Window
- Tip: External Printer and Terminal

9.1.7 Menu Item Store

After a measurement, the results as shown on the screen can be stored in the External Sample Data File by choosing this option. This menu option is only active if: First automatic data transmission has NOT been previously activated, and second the measurement results have NOT already been stored. The output is directly in ASCII-Format or the Spectro 4.3 Protocol, and a parallel output in both formats is also possible. If the additional data management program DIA or DIA-Light is installed, the storage in the Spectro-standard format initiates the data transfer to the DIA program. Select in the dialog box Output Parameters in the window of the Program Development the file name for the respective files. There you can enable the automatic storage of the measurement results.

Alternatively or parallelly to the data management through external programs like DIA, a management of the analysis results is possible with the integrated sample management. The menu item 'save results' does not influence the storage of results for the integrated sample management. read [Sample Management](#) for more details.

See:

- Dialog Box Output Mode
- Dialog Box Output Parameters
- Menu File
- Menu Measure
- Sample Management
- Measure Window
- Data Formats

9.1.8 Menu Item Transmit

Select this menu item to transmit the results of a measurement, displayed on the screen, to an external computer. The transmission is accomplished via the serial interface. This menu item is only enabled on condition that a) you carried out a measurement before, b) the automatic transmission is disabled, c) the measure results are not yet transmitted. The output is done immediately in Spectro 4.3-Protocol. In the window on Program Development you may enable the automatic transmission of measure results by means of the Dialog Box Output Parameters. In the Dialog Box Output Setup in the window of Program Development you may define whether the transmission shall be effected immediately or via a buffer store. In case you buffer the data to be transmitted, you must transmit the buffered data with the menu item Transmit Buffered Data in Menu Extras of the Measure Window.

See:

- Menu Item Transmit Buffered Data
- Dialog Box Output Mode
- Dialog Box Output Parameters
- Dialog Box Output Setup
- Menu File
- Menu Measure
- Menu Extras
- Tip: Data Transmission
- Measure Window

9.1.9 Menu Item Exit

Choose this item to end the Spark Analyzer program. All program windows are automatically closed. However, before proceeding, the software questions if the program is really to be ended. Click the Ok button to end the program or the cancel button to continue in the spectrometer program.

See:

- Menu File
- Measure Window
- Program Development

9.2 Menu Edit (Measure Window)

This menu contains items for editing the current measurement results. It includes items for deleting single measurements as well as editing the data for the current sample. In addition, this menu allows the user to switch the display mode between the various measurement forms, from intensities through to concentrations. The menu contains the following items:

- ➡ **Mark**
Choose the Menu Item Mark to activate (or inactivate) the mark mode. This can also be accomplished by using the <Ctrl>+<M> key combination.
- ➡ **Delete**
Choose this Menu Item Delete to delete selected measurement(s) of the current sample. This can also be accomplished by using the key.

➔ **Delete All**

Select this Menu Item Delete All to delete all measurements of the current sample. This can also be accomplished by using the <Ctrl>+<A> key combination.

➔ **Undo**

Choose this Menu Item Undo to recover the measurement(s) deleted. This can also be accomplished by using the <Ctrl>+<Z> key combination.

➔ **Average**

Select this Menu Item Average to make an average of the individual results shown on the Measure Window. This can also be accomplished by using the <F4> function key.

➔ **Average + RSD**

Choose the Menu Item Average + RSD to make an average of the individual results shown on the Measure Window and also display the standard deviations. This can also be accomplished by using the <F5> function key.

➔ **Single Values**

Select the Menu Item Single Values to display the single results of the measurements made. This can also be accomplished by using the <F6> function key.

➔ **Sample Data**

Select this menu item to open the Dialog Box Sample Data. This dialog box allows the data of the current sample to be edited. This option is only active if the appropriate input format has been defined in the Dialog Box Sample ID Format of the Program Development window. This menu item can also be accomplished by using the <Shift>+<F9> key combination.

See:

Measure Window

9.2.1 Menu Item Mark

Choose this menu item to switch the mark mode on or off in the Measure Window. With the select mode switched on, the currently chosen measurement can be marked by using the <Enter> key or the mouse. The marked measurement(s) can be deleted or shown as deleted.

See:

Menu Item Delete

Menu Edit

Measure Window

9.2.2 Menu Item Delete

This menu option allows the currently marked measurements to be deleted. If no measurements have been selected, then the currently indicated measurement will be erased. Depending on the settings of the global switch on deleted individual values (Dialog Box Options), deleted samples are either marked as 'deleted' in the window; these samples are not used for the calculation of average values. Or the samples are removed from the buffer store finally. Samples which are marked as 'deleted' may be incorporated in the calculation again by means of Menu Item Undo. With the exception of the last deletion, finally deleted samples cannot be retrieved.

See:

- Menu Item Mark
- Menu Item Delete All
- Menu Item Undo
- Dialog Box Options
- Menu Edit
- Measure Window

9.2.3 Menu Item Delete All

Choose this menu item to delete all displayed measurements. This is useful if, for example, the measurement of a sample is to be repeated.

See:

- Menu Item Mark
- Menu Item Delete
- Menu Edit
- Measure Window

9.2.4 Menu Item Undo

Select this menu item to remove the marking from all 'deleted' measurements and to incorporate the values into the mean value calculation again. The menu item is enabled provided some measurements were marked as 'deleted' and the global switch for deleted single values (Dialog Box Options) was set accordingly.

In case the global switch for deleted single values is set to 'final', only the last deletion may be canceled.

You may also select this menu item if you want to reset edited mean values to the original values.

See:

- Menu Item Mark
- Menu Data
- Menu Item Delete All
- Dialog Box Options
- Menu Edit
- Measure Window

9.2.5 Menu Item Average

Use this item to make and display the average of the measurements on the Measure Window. This menu option is only active if the display average has not already been switched on. The results to be displayed can be set through the Dialog Box Output Mode.

See:

- Menu Item Average + RSD
- Menu Item Single Value
- Dialog Box Output Mode
- Menu Edit
- Measure ,Window

9.2.6 Menu Item Average + RSD

Select this menu item to display the average and relative standard deviation (RSD) for the measurements on the Measure Window. This menu item is enabled provided that the display 'average values' and 'statistics' are not yet switched on. The values to be displayed in the Measure Window may be defined in the Dialog Box Output Mode.

See:

- Menu Item Average
- Menu Item Single Values
- Dialog Box Output Mode
- Menu Edit
- Measure Window

9.2.7 Menu Item Single Values

Select this menu item to display the values of individual Measurements in the Measure Window. This menu item is enabled provided that viewing of single values is switched on. Up to 20 single measurements may be displayed in that way. The last 5 of the 20 measurements are visible in the window, in case you wish to view the previous data you may display the values using the scroll bar. You may use the arrow keys alternatively. If the number of measurements exceeds 20, an averaging on the respective values beyond 20 will be effected. These average values are stored in an additional memory position but are not displayed. The types of values to be displayed in the Measure Window is defined in the Dialog Box Output Mode.

See:

- Menu Item Average
- Menu Item Average + RSD
- Dialog Box Output Mode
- Menu Edit
- Measure Window

9.2.8 Dialog Box Sample Data

This dialog box is used to edit the data on the current and next sample to be measured respectively. The dialog box is opened through the menu item **Edit sample data** and **Next sample**. The dialog box is opened provided that type and number of input fields were entered in Program Development in the Dialog Box Sample-ID-Format. Selection of this dialog box may be delayed due to missing of a pre-user task or a necessary file with field contents. Then the message 'Wait for external sample-ID' is displayed in the status bar of the measure window. For further information please refer to the text below and to the help text for the Dialog Box Sample-ID-Format. The dialog box contains the following dialog elements:

Group Box Sample Data

Edit fields 1 to 5 resp. 1 to 19

Enter the respective information into the displayed edit fields. You may decide number, type, name of the edit fields through the **Dialog box Format Sample-ID** in the **Program Development** window.

In case you select a field of the type 'Quality', then this field is displayed as a combo box. This combo box contains a list of all alloy grades of the actual base, from which you may select an entry.

Selecting an entry from a chosen list is also possible for the other edit fields. Sometimes it is practical to use a predefined sample identification, if some names are often repeated. To display a sample identification field as a combo box, you have to select the entry 'User defined sample ident.' in the **Dialog box Format Sample-ID** in the column 'Origin'.

Look under the keyword **Parameter Files** for an example.

When you open the dialog, the single edit fields may be completed with single entries. To do this, a suitable file containing these entries must exist. Additionally the entry 'external' must be selected in the dialog box 'sample-ID-format', table column 'origin'. For further information please refer to the help text for the **Dialog Box Sample-ID-Format**.

Button Delete

Select this button to delete and reset resp. the currently displayed data in all edit fields.

Button OK

Click on this button to close the dialog box and accept the new entries. The entries in their fields are transferred to both, to the measure window and to the file SID_STA.ASC in the subdirectory \status. Now the values are available for further processing. The selection of the measure window may be delayed, because a post-application had been previously decided. For further information please refer to the help text for the Dialog Box Sample-ID-Format.

Button Cancel

Click this button to close the dialog box. The changed values are not stored.

See:

Dialog Box Sample-ID-Format
Menu Edit (Measure Window)
Measure Window

9.3 Menu Measure (Measure Window)

This menu contains menu items to carry out measurements of production samples and to carry out and to check standardization. The menu is exclusively displayed in the Measure Window. The menu contains the following menu items:

➔ **Next Sample**

This menu item is used to output and to store the results of the last sample. Afterwards the Dialog box Sample Data may open to enter a sample identification for the next sample. The display on the measure screen is deleted. You may start now to measure the next sample. You may call-up this menu item with the short cut <F9> or with the respective icon down on the bottom of the Measure Window.

➔ **Start**

You start the next measurement with the Menu item Start. You may call-up this menu item with the short cut <F2> or with the respective icon down on the bottom of the Measure Window.

➔ **Stop**

You may stop the running measurement with the Menu item Stop. This may be useful in case you detect faults during a measurement, e.g. the sample is not positioned properly or the sample was mixed-up. You may call-up this menu item with the short cut <F3> or with the respective icon down on the bottom of the Measure Window.

➔ **Multiple Measurement**

You start a multiple measurement of the sample, which is positioned onto the spark stand, with the Menu item Multiple Measurement. Please note that the sample shall be turned or grinded after each single measurement if you want to obtain good analytic results. You may call-up this menu item with the short cut <Shift>+<F2>.

➔ **Last Measurement**

By means of the Menu item Last Measurement you may use the values of the last sparking for a new calculation, e.g. after a change of the analytic program. You may call-up this menu item with the short cut <Alt>+<F2>.

➔ **Control Sample Test**

With this menu item you open the Dialog box Control Sample Test, to check the correctness of the standardization of the selected Analytic Program by means of a Control Sample Test. You may call-up this menu item with the short cut <F11> or with the respective icon down on the bottom of the Measure Window.

➔ **Standardization**

With this menu item you open the Dialog box Standardization, to start a Standardization using the currently loaded Analytic Program. You may call-up this menu item with the short cut <F7> or with the respective icon down on the bottom of the Measure Window.

➔ **Global Standardization**

With this menu item you open the Dialog box Global Standardization, to carry out a global standardization. You may call-up this menu item with the short cut <Shift>+<F7>.

➔ **Type Standardization**

With this menu item you open the Dialog box Type Standardization, to start a type standardization for the currently loaded Analytical Program. You may call-up this menu item with the short cut <F8> or with the respective icon down on the bottom of the Measure Window.

➡ Load Type Standardization

With this menu item you open the Dialog box Load Type Standardization, to load an existing type standardization for the selected Analytical Program. You may call-up this menu item with the short cut <Shift>+<F8>.

➡ Delete Type Standardization

With this menu item you unload the currently loaded Type Standardization Sample. Now it is not still longer possible to display type-standardized values. You may call-up this menu item with the short cut <Ctrl>+<F8>.

See:

Measure Window
Menu Instrument

9.3.1 Menu Item Start

Select this menu item in order to begin the measurement of a production or standard sample. Ensure that the sample is sitting properly, i.e., flat and completely covering the spark stand electrode opening. The sample clamp must be in the down position. Also pay attention to the display in the second field of the Status row at the bottom of the Measure Window. This shows the current state of the Instrument Control System. Possible error messages are, for example:

➡ Sample Clamp Up

Set the sample clamp down on the sample and restart the measurement.

➡ Source Off

This error message is often caused by a broken contact between the sample and the sample clamp during the measurement. A safety switch then shuts off the excitation source. The source must now be manually switched off and then on again. Then the measurement can be re-started.

See:

Menu Measure
Measure Window

9.3.2 Menu Item Stop

This menu item allows the user to break off the current measurement in progress. This may be necessary if a problem is noted during the measurement and it becomes clear that waiting until the measurement cycle is complete is a waste of time and/or the results are either unnecessary or unwanted. Such a problem may occur if, for example, the spark stand opening is not completely covered by the sample (in this case the spark sound will be noticeably louder). Another example is that the operator notices that the wrong sample is being sparked.

See:

Menu Measure
Measure Window

9.3.3 Menu Item Multiple Measurement

With this menu item you may start a multiple measurement on the sample which is positioned on the spark stand. You call-up the menu item from the Menu Measure of the Measure Window. A small dialog box opens, and you may enter the number of single measurements to be carried out. The default value is 5 single measurements, but this value may be overwritten. A permanent modification of the default value is not possible. Please note that the sample shall be turned or grinded after each measurement to achieve good analytic results. This is reason why the multiple measurement is only suitable for measurements which are not evaluated analytically. Examples are 'warm-up-sparking' to come to the operating temperature of the spectrometer or measurements for a Reprofiliation of the spectrometer. Another start of the reprofiliation measurement offers the Menu Instrument in the Measure Window You may call-up this menu item with the short cut <Shift>+<F2>.

See:

- Menu Measure
- Measure Window

9.3.4 Menu Item Last Measurement

This menu option allows retrieval of the results of the last measurement onto the Measure Window. This may be useful after a change of Analytical Programs or a change of calculation parameters. The option provides the possibility of recalculating the results of a measurement under different conditions.

See:

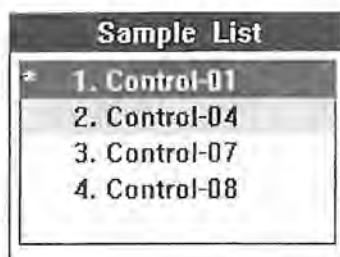
- Menu Measure
- Measure Window

9.3.5 Dialog Box Control Samples Test

This dialog box is used to select the control samples to be measured. You may skip proposed control samples or change the order the control samples are measured. You get a permanent change of the control sample sequence through rearranging the samples in the Dialog box Control Samples in the window on Program Development. In the course of a control sample test the dialog box 'Measure control samples' opens automatically when you start Carry out a Control Sample Test or when you select the menu item **Next sample** or <F9> in the Menu Measure.

Place the named control sample onto the spark stand. If you want to measure another control sample, you may skip the requested control sample by means of the buttons in the dialog.

A list of all control samples which shall be requested for the current Analytical Program is displayed on the screen right on the top. The next sample to be measured is highlighted yellow. Finished samples are highlighted green during the procedure. You may change to another sample than the proposed sample through a click on the desired sample name in the list box.



The dialog box contains the following dialog elements:

Display field Sample Name

This field displays the name of the next control sample to be measured.

Button Prev. Std.

Click this button to select the previous control sample from the sample list.

Button Next Std.

Click this button to select the next control sample from the sample list. When you click this button after the last control sample is finished, the control sample test will be finished.

Button OK

Click this button to shut down the dialog box and to confirm the selection.

Button Cancel

Click this button to shut down the dialog box. The measurement of control samples stops.

See:

- Menu Measure
- Measure Window
- Dialog box Control Samples
- Program Development

9.3.6 Dialog Box Standardization

This dialog box is used to begin a standardization of the instrument. It is accessed via the menu item Standardization in the Menu Measure. The dialog box contains the following options:

Display Field Date and Time

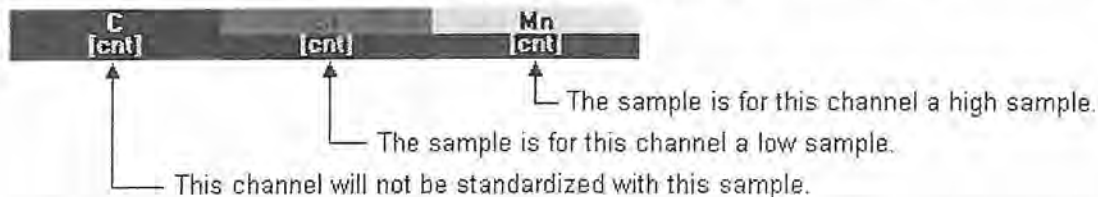
This field displays the date and time of the last instrument standardization. The standardization process should be carried out a regular time intervals, for example, at the beginning of each shift.

Button No

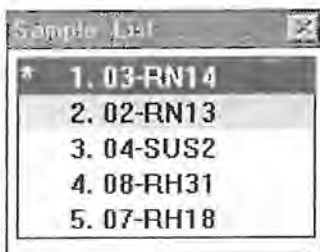
Click this button to break off the standardization process and close the dialog box.

Button Yes

Click this button to begin the measurement of the standardization samples. The dialog box is closed and the Measure Window display changes as follows:



In the top left corner of the screen a window displays the list of standardization samples to be measured. The following graphic shows an example:



The standardization sample names are shown in the list. The green highlighted names preceded by an asterisk are the samples that have already been measured. Shown in yellow is the name of the next sample to be measured. Therefore, this list shows at a glance the user's progress in the measurement of the standardization samples. If more than five samples are required for the standardization, a page scroll bar is displayed at the right side of the list.

In the middle of the screen the Dialog Box Standardize Program is shown. With this Dialog Box the user can control the order in which the standardization samples are to be measured. In addition, it is possible to skip over, i.e., not measure, selected samples.

See:

Menu Measure
Measure Window

9.3.7 Dialog Box Standardize Program

This dialog box allows the selection of the standardization samples to be measured. It is automatically opened when the standardization process is initiated in the Dialog Box Standardization, or the menu item Next Sample in the Measure Window is selected during the standardization. The dialog box contains the following items:

Display Field Sample Name

The name of the next standardization sample to be measured is shown in this field.

Button Last Standard

Click this button to select the previous standard in the list of standardization samples.

Button Next Standard

Click this button to select the next standard in the list of standardization samples.

Button Ok

Click this button to close the dialog box and verify the selection.

Button Cancel

Click this button to close the dialog box and break off the standardization process.

After the measurement of the last standardization sample the calculation of the correction factor and offset begins automatically. If not all samples have been measured, this will be noted on the display. The Dialog Box Standardization Data is automatically displayed after the calculation has been completed. Check the factors and offsets and close the dialog box. The standardization is complete.

See:

Menu Measure
Measure Window

9.3.8 Dialog Box Global Standardization

This Dialog Box serves to start a Global Standardization for all Analytical Programs of the selected matrix or base element. It is opened through the menu item Global Standardization in the Menu Measure of the Measure Window. This dialog box is identical to the Dialog Box Standardization. Even the procedure which follows thereafter is quite similar to a standardization.

As opposed to a regular Standardization, which is only used in the currently loaded Analytical Program, with a Global Standardization the standardization samples for all Analytical Programs of a base/matrix element are measured. This saves the time involved in remeasuring the samples common to the various Analytical Programs of a certain base element. When the menu item global standardization is chosen, the currently loaded Analytical Program is automatically replaced by the global standardization program of the appropriate base element. Thereafter, the standardization samples must be measured as requested by the software. The measured intensities are then stored in a special file. Calculation of the standardization data then proceeds automatically the next time an Analytical Program of this base/matrix element is loaded.

When the measurement of the standardization samples has been completed, the Standardization Data for the global standardization program are shown on the screen. With the help of this dialog box the user can determine if the measurements have been correctly carried out.

See:

Menu Measure
Measure Window

9.3.9 Dialog Box Type Standardization

This dialog box permits the selection of a type standardization sample, the subsequent measurement of this sample, and the calculation of the new Type Standardization correction factors. The dialog box is opened through the menu option Type Standardization in the Menu Measure of the Measure Window. Alternatively, click the appropriate symbol at the bottom of the Measure Window or use the <F8> function key. The dialog box contains the following elements:

Edit Field Type Standardization Sample

Enter the name of the desired type standardization sample in this field. If a type standardization sample is selected from the list described in the following menu option, the name is entered in this field.

List Box Select Available Samples/Last Measurement

This list shows the available type standardization samples for the selected Analytical Program along with the date and time of last measurement. Click on a sample name to select.

Button Cancel

This button closes the dialog box and cancels the type standardization process.

Button Ok

Click this button to close the dialog box, confirm the sample selected, and start the measurement of the type standardization sample.

A dialog box is displayed to confirm the start of type standardization and show the date and time of the last measurement of the selected sample. Click the button Yes and then begin the measurement with the <F2> function key or by clicking the appropriate symbol at the bottom of the Measure Window. Thereafter make further measurements to improve the statistics.

After completion of the measurements choose the menu item Next Sample in the Menu Measure or use the <F9> function key or click on the appropriate symbol at the bottom of the Measure Window. The type standardization factors will be calculated and the Dialog Box Type Standardization Data is automatically displayed. Now the results of the Type Standardization can be checked.

See:

Menu Measure
Measure Window

9.3.10 Dialog Box Type Standardization Data Overview

This dialog box serves to check the results of the Type Standardization. It is automatically shown after the dialog boxes Type Standardization and Load Type-Standardization. This dialog box contains the following elements:

Table Field Element Data

This table shows the type standardization data for each element. The following columns are shown:

Column Field Element

The element symbol is shown in this column.

Column Field Check Value

If this field is marked, the value(s) for the indicated element should be checked. The type standardization should not be accepted.

Column Field Certified Concentration

The certified concentration for each element of the type standardization sample is given in this column.

Column Field Minimum Concentration

This column shows the minimum concentration assigned for each element.

Column Field Measured Concentration

The measured concentration (not type standardized) for each element is shown in this column.

Column Field Maximum Concentration

This column shows the maximum concentration assigned for each element.

Column Field Use Factor

Select this field to use the type standardization correction factor for the specified element. If this column is left unmarked, then the calculated correction offset will be applied.

Column Field Factor

This column shows the calculated correction factor.

Column Field Offset

This column shows the calculated correction offset.

Column Field Measured RSD

The RSD of the measurements on the type standardization sample are shown in this column.

Column Field Maximum RSD

The maximum allowed RSD for the type standardization sample are shown in this column.

Button Ok

Click this button to close the dialog box and accept the values (correction factors or offsets) displayed. The Type-Standardization is now activated. The type standardized concentrations can be displayed through the menu item Output Mode in Menu Extras or the type standardization switched off in the Menu Measure.

Button Cancel

Click this button to close this dialog box.

Button Print

Click this button to print the values shown in the table.

See:

- Dialog Box Type-Standardization
- Dialog Box Loading Type-Standardization
- Menu Measure
- Measure Window

9.3.11 Dialog Box Load Type Standardization

This dialog box is used to select a type standardization sample, whose data are called-up into the memory for Type Standardization of production samples. The corrective data, which are linked with the type standardization sample, were previously determined through measuring the type standardization sample. Take care that the measurement of the type standardization sample is not so long ago: the loaded corrective factors could be invalid for the current device state. The dialog box is opened through the menu item **Type standardization** in the Menu Measure of the Measure Window. Alternatively you may use the short cut <Shift> + <F8>. The dialog box contains the following dialog elements:

Edit field Selected Sample

In this field you may enter the name of the desired type standardization sample. If you select a type standardization sample from the list box described below, the name of the selected sample is displayed in this field.

List box Available Sample/Last Measurement

This field displays both, the available type standardization samples which are selected for the Analytical Program and date and time of the last measurement of the respective sample. Click on the list to select a sample.

Button OK

By means of this button you close the dialog box to confirm the selection and to load the corrective data for the selected type standardization sample. The Dialog Box Type Standardization Data is automatically displayed on the window. You may check the results of the Type Standardization by means of this dialog box.

Button Cancel

By means of this button you close the dialog box and the loading process is interrupted.

See:

- Dialog Box Type Standardization
- Dialog Box Type Standardization Data
- Carry out a Type Standardization
- Menu Measure
- Measure Window

9.4 Menu Program (Measure Window)

This menu contains items to view and change parameters of the currently selected Analytical Program. Changes apply to the loaded analytic program exclusively and cannot be stored. A permanent storage of parameters may be effected through the window on Program Development. The menu contains the following menu items:

➔ **Prespark Time**

Select this menu item to open the Dialog Box Prespark Time for setting the Prespark Time.

➔ **Output Parameters**

Select this menu item to open the Dialog Box Output Parameters. By means of this dialog box you define the device and the file resp. the automatic output shall be effected.

➔ **Element Format**

Select this menu item to open the Dialog Box Element-Format. By means of this dialog box you define a) whether the results shall be output on the several devices and files resp., b) the shape of the output just mentioned.

➔ **Standardization Results**

Select this menu item to open the Dialog Box Standardization Results. By means of this dialog box you may check the results of the last Standardization.

➔ **Calibration Ranges**

Select this menu item to open the Dialog Box Calibration Ranges. By means of this dialog box you may view the calibration ranges of the currently loaded analytic program.

See:

Menu Edit (Program Development)
Measure Window
Program Development

9.4.1 Dialog Box Prespark Time

This dialog box makes possible a temporary change of the prespark time(s). Such a change may be useful, for example, when thin sheets are to be measured. In this case, the high energy prespark time should be reduced to avoid burning through the sample. The dialog box may be opened through the menu item Prespark Time in the Menu Program of the Measure Window. The dialog box contains the following elements:

Table Field Prespark Time

The first column of this tabular field shows the defined prespark periods and the second column the associated time in seconds.

Button Ok

Click this button to close the dialog box and save all changes. The measurements that follow will be carried out with the new prespark time(s).

Button Cancel

Click this button to close this dialog box. Any changes made will not be stored to memory.

Note:

Changing the prespark time is only possible at User-Level 2 or higher.

The change of the prespark time is only temporary. If another, or the same, Analytical Program is loaded, then the previous values are again set. For a permanent change of prespark time use the appropriate function in the Program Development window.

See:

Menu Program
Measure Window

9.4.2 Dialog Box Standardization Data

This dialog box is displayed under two circumstances: First it may be called up from the Menu Program of the Measure Window to display the results of the last Standardization of the currently loaded Analytical Program. These results will show if all Channels were still within an acceptable range. Second the dialog box is automatically shown after a standardization has been completed. The decision to accept the standardization or not is made by inspection of the results and comparison with the acceptable range. A standardization is started through the menu item Standardization in the Menu Measure of the Measure Window. This dialog box contains the following options:

Table Field Channel Data

In this field the following data is displayed for each Logical Channel:

Column Field Channel

This column shows the names of the Logical Channels.

Column Field Check Val.

Whether the Standardization correction factors/offsets are within the acceptable limits is shown in this column. If this column is marked/checked then at least one of the correction values (factor and/or offset) of the associated Logical Channel is outside of the allowed tolerances. This value is highlighted in red.

Column Field Factor

The calculated standardization factor for the correction of the measured values is shown in this column. Ideally this factor would be 1.

Column Field Offset

The calculated standardization offset for the correction of the measured values is shown in this column. Ideally this offset would be 0.

Column Field Type

This column shows the type of Standardization being used for each Logical Channel. Possible entries are One-point and Two-point standardization.

Column Field Low Sample [%] Deviation

The deviation of the Low Sample for each Logical Channel from the results of the previous Standardization is shown in percent. Ideally, the deviation would be 0.

Column Field High Sample [%] Deviation

The deviation of the High Sample for each Logical Channel from the results of the previous Standardization is shown in percent. Ideally, the deviation would be 0.

Button Close

Click this button to close the dialog box. This button will only appear if the dialog box was opened through the menu item Standardization Results.

Button Ok

Click this button to accept the standardization results. This button is only shown if the dialog box is opened after completion of a standardization.

Button Cancel

Click this button to break off the standardization process and retain the previous standardization data. This button is only shown if the dialog box is opened after completion of a standardization.

Button Print

Click this button to print the results of the standardization.

Note:

The standardization parameters and samples are defined through the Program Development window using the menu items Standardization Sample and Standardization Parameters in the Menu Edit.

If only a single Channel shows an unacceptable deviation, then it is possible that there is some problem with this channel, for example, a defective light-detector modul or a broken fiber optic. In such a case, it is advisable to contact Spectro-Service.

If several channels show unacceptable deviations, then it is possible that a sample was not properly placed on the spark stand resulting in a bad spark, or that two (or more) samples were mistakenly switched during the measurement sequence. Check for these possibilities and, if indicated, remeasure the appropriate samples.

Note that the system will still function even if the standardization results are outside of the acceptable limits. In this case, however, it is advisable to check the standardization by measuring an appropriate control sample before proceeding with production samples.

See:

Measure Window
Program Development
Menu Program
Menu Measure
Dialog Box Standardization
Dialog Box Standardization Parameter
Dialog Box Standardization Samples

9.5 Menu Instrument (Measure Window)

This menu provides items for the control of the stationary metal analyzer. The following items are available:

➔ **Argon Flow**

Choose this menu item switch the Argon Flow on or off. This option can also be executed by using the <Ctrl>+<F> key combination.

➔ **Reprofile Optics**

Select this menu item to carry out a Reprofileing. The procedure is described in the section Carry out a Reprove.

➔ **Dark Current Test**

Choose this menu item to open the Dialog Box: Dark Current Test and perform this test.



This menu item is not available for SPECTROLAB Jr. CCD.

➔ **Constant Light Test**

This menu item opens the Dialog Box Constant Light Test and allows this test to be carried out.



This menu item is not available for SPECTROLAB Jr. CCD.

➔ **Reset Spark Counter**

Choose this item to reset the spark counter.

➔ **External Control**

Choose this menu item to toggle the control of the spectrometer through a superordinated computer. This superordinated computer is the Master computer in an automatized system (SPECTROLUX), which controls not only the analysis but also the

sample preparation and sample handling. With standard spectrometers this menu item is not accessible. You may also enable this menu item through the key combination <Ctrl> + <Y>. With an automated system, this menu item must be selected after each restart.

See:

Measure Window

9.5.1 Dialog Box Reprofilng

No description to this dialog box available.

See:

Menu Measure
Measure Window

9.5.2 Dialog Box Setup SIM-Profilng

Beschreibung

9.5.3 Menu Item Dark Current Test

Here you can start the dark current test. The Dark Current Test is a useful instrument check for measurement of the dark current intensity of light detectors. You specify the number of single measurements and the criteria, used for intensity evaluation, in the Dialog Box Dark Current Test. You open the dialog box dark current test with the submenu 'installation' in the Menu Instrument of the program development.

When starting the dark current test, the measure window shifts into the output mode 'raw intensities'. It is not necessary to put a sample on the spark stand of your Spectrometer, because the channel signals are to be determined independently from light. The single measurements to follow are automatically carried out. When the measurement sequence is finished, the mean value and absolute standard deviation is also automatically calculated.

Evaluation

- ▶ A **successful finish** of the dark current test is displayed with the message 'Dark current test OK'. Confirm this message by OK.
- ▶ In case of **faults** the message 'Dark current test not OK' is displayed. All the channels are marked in color, when the intensities do not correspond to the criteria adjusted in the Dialog Box Dark Current Test.
 - ◆ If the **Dark Current Intensity** is too high compared to the low sample, the mean value of this channel is displayed in black letters with purple background. Additionally a >> is placed in front of the mean value.
 - ◆ If a channel shows an **Absolute Standard Deviation** of the dark current signal to be too high, the mean value of this channel is displayed in black letters with yellow background. If printed out, the mark '!' is placed in front of the mean value.
 - ◆ If a reference channel shows a dark current signal to be too high compared

with the typical intensity, the mean value of this channel is displayed in black letters over purple background. Additionally a >> is placed in front of the mean value.

Confirm the error with OK.

To continue the routine work, press the key F9 or the corresponding button 'next sample' at the bottom of the window.

See:

Menu Instrument
Measure Window
Menu Item Constant Light Test
Dialog Box Dark Current Test

9.5.4 Menu Item Constant Light Test

You start the constant light test with this menu item. The Constant Light Test is an instrument check to supervise the long term stability of the Spectrometer electronics. A LED constant light source is installed into each optical system of your stationary metal analyzer. When you start the constant light test, these LED's are switched on and the intensity signal is the output. You specify in the Dialog Box Constant Light Test the number of single measurements and the criteria of intensity for evaluation. You open the dialog box 'Constant Light Test' via the sub menu 'Installation' of the Menu Instrument in the program development.

When the constant light test starts, the measure window shifts to the output mode 'raw intensities'. You don't need to put a sample on the spark stand of the Spectrometer, because the measured light intensity is not emitted by the sample but the LED light source. The single measurements are accomplished automatically. Then the automatic average calculation and the calculation of the relative standard deviation is accomplished.

Evaluation

- ▶ The message 'Constant Light Test OK' confirms the **successful finish of the constant light test**. Confirm this message with 'OK'.
- ▶ In case the measurement is faulty, the message 'error - constant light test not OK' is displayed. All the channels are marked in colors, when the intensities do not correspond to the criteria which are set in the Dialog Box Constant Light Test.
 - ◆ If the determined relative standard deviation is too high, the mean value of the exceeding channel is displayed in black letters over yellow background. The printer marks the average value by a '!'.
 - ◆ If the permitted deviation between the average of the last 3 constant light tests and the current test is too high, the mean value of the exceeding channel is displayed in black letters over pink background. Additionally the mark '>>' is added to the value.

The following figure shows you the screen display of both errors. If you read this text printed on paper, you will not be able to distinguish the different colors.

Cr1 [cnt]	Mo [cnt]
22969	22969
160	52
0.695	0.177

Confirm the error with OK.

To continue your routine work, click then the key F9 or the corresponding button 'next sample' on the bottom of the window.

See:

Menu Instrument
Measure Window
Menu Item Dark Current Test
Dialog Box Constant Light Test

9.6 Menu Extras (Measure Window)

This menu contains menu items for optional settings, special functions, display of additional data. Select one of the following menu items:

- ➔ **Output Mode**
Select this menu item to open the Dialog box Output Mode. This dialog box allows you to configure measure results.
- ➔ **Options**
Select this menu item to open the Dialog box Options. This dialog box allows you to carry out optional settings for the Measure Window.
- ➔ **Alloy Grade Library**
Select this menu item to open the Dialog box Alloy Grade Library. You may enable this menu item with the key combination <Ctrl>+<Q>.
- ➔ **Find Alloy Grade**
Select this menu item to carry out an Alloy Grade Search. You may enable this menu item with the key combination <Ctrl>+<U>.
- ➔ **Transmit Data Buffer**
Select the Menu item Transmit Buffered Data, to display a survey of the short cuts.
- ➔ **Change Password**
Select this menu item to open the Dialog box Change Password .

See:

Measure Window

9.6.1 Dialog Box Output Mode

This dialog box serves to set the display mode of the measurement results. The dialog box is accessed through the menu item Options in the Menu Extras of the Measure Window. This dialog box contains the following items:

Group Box Channel & Element Data

Display Field Channel Data

In this field the number of channels to be displayed is shown.

Display Field Element Data

In this field the number of elements to be displayed is shown.

Group Box Output Data

By choosing one of the following options, the measurement display mode on the screen is determined. The selection of these various measurement display modes makes it possible to follow step-by-step the results of a spark measurement from measured channel intensities through to the calculation of type-corrected or type-standardized concentrations.

Radio Button Channels:**Raw Intensity**

This field displays the **Raw Intensity** of the individual channel of the **Analytical Program** on the **Measure Window**.

Intensity Ratio

This field allows the display of the Intensity Ratios, that is, the measured intensities ratioed to the base element.

Standardized Intensity Ratio

Choosing this field will show the Standardized Intensity Ratio.

Interelement Corrected Intensity Ratio

This field displays the Interelement Corrected Intensity Ratio on the Measure Screen.

Concentration Ratio

This field displays the Concentration Ratio of the each element.

Matrix Corrected Concentrations

The Matrix Corrected Concentrations are displayed using this option.

Radio Buttons Element:**Concentration**

Choosing this field results in the display of the **Element Concentrations** on the **Measure Window**.

Type Corrected Concentrations

This field allows the display of a Type Standardization corrected concentration. Note: This option is only possible when the menu option Type Standardization has been loaded beforehand through the Menu Measure, and a type standardization sample has been chosen.

Button Close

Click this button to close the dialog box and change actual output mode.

Button Ok

Click this button to close the dialog box. The output will not be changed.

Note:

Switching between these various measurement display modes is also possible by using the <+> and <-> keys of the number keypad.

Type corrected concentrations will only be displayed if a Type Standardization has been previously loaded or carried out.

See:

Menu Extras (Measure Window)
Measure Window
Evaluation of Measure Results

9.6.2 Dialog Box Options

This dialog box is used to set global options for the Measure Window. The dialog box Options enables you to change settings temporarily, which were made in the program development in the Dialog Box Global Parameters. The dialog box is opened through the menu item **Options** in the Menu Extras (Measure Window). The dialog box contains the following dialog elements:

Group Box Options

Check Box 'Delete Single Values Finally'

Click this field to decide if deleted single values are erased from the buffer store in case you selected the **Menu Item Delete** in **Menu Edit**. In case the box is not marked, the values are just marked as 'deleted'. All these marked values may be incorporated in the calculation through the **Menu Item Undo** again. In case of a final deletion only the last deletion will be undone.

Check Box 'Automatic Program Selection'

Click this field to decide whether a suitable Analytical Program will be loaded automatically after a Measurement based on a loaded Orientation Program.

Check Box 'Load Orientation Program Automatically'

Click this box to decide if in case where an Analytical Program had been loaded automatically, the Orientation Program will be reloaded automatically during the next measurement.

Check Box 'Auto Average'

Click this box to decide if the Spectrometer program shall carry out automatically an average calculation after a selected number of single measurements. The settings for automatic average calculation are done in the Dialog Box Auto. Average Parameters. There you will find a description of the function.

Check Box 'Alloy Grade Test'

Click this box to decide if an alloy grade test is carried out together with the average calculation. A comparison between each element average value and the stored alloy grade limit values is made and the results are displayed in colors. For further information see Carry out an Alloy Grade Test.

Button OK

Click this button to shut down the dialog box and to read-in the modified settings.

Button Cancel

Click this button to shut down the dialog box. The modified settings are not read-in.

See:

- Dialog Box Global Parameters
- Menu Extras (Measure Window)
- Measure Window
- Carry out an Alloy grade Test.

9.6.3 Dialog Box Alloy Grade Library

This dialog box serves to edit the Alloy Grade Library. It is accessed through the menu item Alloy Grade Library in the Menu Extras in the Measure Window or opened in the Program Development window. The following items are available:

Group Box Search & Sort Criteria

The options of this field allow the selection of the search and sort criteria for the Alloy Grade Library.

Edit Field Alloy Name

This field allows for a search by name in the Alloy Grade Library. Enter the name of the Alloy Grade and click to the button Search. The data for the first Alloy Grade found matching this name will be displayed.

Edit Field Base Element

Enter the name of the Base Element of the Alloy Grade to be found. Click to the button Search and the first data corresponding to this criterion will be displayed.

Edit Field Analytical Program

Here the name of an Analytical Program may be entered as a search criterion. Click to the button Search and the first data which provides a match will be displayed. Note: This option is only active if the third sort criteria noted below has been chosen.

Button Search

A click on this button will find the first alloy grade data corresponding to the entered search criteria. If none of the stored data fields match the entered criteria, an empty list will be displayed.

Radio Button 1. Sort by Name

Choosing this field will sort the Alloy Grade Library by alloy grade name and display alphabetically.

Radio Button 2. Sort by Base Element & Name

This field allows a sorting and display of the Alloy Grade list by Base Element and alloy grade name.

Radio Button 3. Sort by Base Element, Analytical Program, & Name

This field should be chosen to sort the list of alloy grades for display according to Base Element, Analytical Program, and name of the Alloy Grade.

List box Alloy Grades

This field displays the list of stored Alloy Grades. A particular alloy grade may be selected with the click of the mouse or by using the arrow keys. The following software switches allow the user to page through the Alloy Grade Library, make changes or delete selected alloy grades, and add new alloy grades to the list.

Button Next Page

Click this button to advance page by page through the alloy grades list. The <Pg Up> and <Pg Dn> keys can also be used to page through the list.

Button Previous Page

Click this button to return to an earlier page of the alloy grades list. The <Pg Up> and <Pg Dn> keys can also be used to page through the list.

Button File Home

Click this button to return to the first page of the alloy grades list. This can also be accomplished by using the <Home> key.

Button File End

Click this button to move to the last page of the alloy grades list. This can also be accomplished by using the <End> key.

Button Edit

Click in this button to open the Dialog Box Edit Alloy Grade and change the alloy grade data for the alloy previously selected.

Button New

Click in this button to open the Dialog Box Edit Alloy Grade and enter a new alloy grade and data.

Button Delete

Click this button to delete a selected Alloy Grade. To delete, respond with button Yes to the question: Delete This File? After deletion, the alloy grade cannot be retrieved!

Button Copy

Click this button to open the Dialog Box Edit Alloy Grade and create a new alloy grade for the alloy grades list. The data of the previously selected alloy grade will be copied to the new record.

Button Close

A click to this button closes the dialog box. Changes made to the alloy grade list are automatically stored to memory.

See:

- Menu Extras (Measure Window)
- Menu Extras (Program Development)
- Measure Window
- Program Development

9.6.4 Dialog Box Edit Alloy Grade

This dialog box allows to edit the alloy grade data. It can be opened by activating any one of the buttons Change, Copy, or New in the Dialog Box Alloy Grade Library. Another selection of the dialog box is through the Dialog Box Matching Alloy Grade, but it is not possible to change limit values. The following dialog elements exist:

Edit Field Name

This field allows the entry of an up to 30 character name for the Alloy Grade.

Edit Field Base Ele.

The Base Element of the Alloy Grade must be entered in this field.

Combo Box Pgm.

This field allows the selection of the Analytical Program in which samples of this Alloy Grade are to be analyzed.

Combo Box Type Stdz.

In this field the standard sample to be used for the Type Standardization of a particular Alloy Grade may be defined.

Edit Field Comment

Up to 50 characters are allowed for comments regarding the Alloy Grades.

Group Box Alloy Grade Limits

This window contains the items for editing target and tolerance concentration values for the various elements of a particular Alloy Grade.

Table Field Element List

The specified elements for an alloy grade along with their concentration limits and target or nominal values may be entered in this table. Also, the way in which the limits are displayed on the screen may be defined.

Column Field Element

Enter here the element symbols which are part of the sample of this alloy grade.

Column Field Format

The output format for the numerical results (concentration values) is defined in this column. Enter a "D" for a "dynamic" display or enter a number from one to five to define the number of characters to be displayed after the decimal point.

Column Field Unit

The concentration units for the various elements are to be entered in this column.

Column Fields External Min., Internal Min., Internal Max., and External Max.

Enter here the concentration limits of elements used for the assignment of a sample to

a quality. The average representation in the measure window displays both values. When displaying 'mean values and standard deviation' only such values are displayed, which are actually used to assign the quality. In a parameter file is defined if these values are external or internal limits.

If you want to check the sum of impurities, you should define only the upper limits for the impurity elements. Read carry out a quality test for more information.

Column Field Target

The target or nominal concentrations of the alloy grade are entered in this column.

Column Field Ext W., Int W.

These fields are needed in the search for matching alloy grades through the extended mode, classification procedure KLASSOR. Enter here the weighting for the external or internal limit values. Example: 1 for single weighting.

Column Field Min Tol., Max Tol.

These fields are needed in the search for matching alloy grades in the extended mode, classification procedure KLASSOR. Enter here the tolerances in % for the external or internal limit values. Example: 10 for 10% tolerance.

The function of the alloy grade search is described under the keyword Carry out an Alloy Grade Search. There you can find more details how to complete in the fields Ext W., Int W., Min Tol., Max Tol. By using these fields the alloy grade search can be controlled and a matching alloy grade can still be found even if a discrepancy has altered the limit value of an unimportant or unprecise element. Provided that you do not intend to work with weightings and tolerances according to the KLASSOR procedure, you do not need to complete the fields mentioned above.

The setting how to operate is effected in the Parameter File PS_GEN.ASC. The classic alloy grade search with no weightings and tolerance windows is a default.

Combo Box Default Unit

In this field select the default value for the concentration units. After entering an element in an empty row, this default value is automatically set for the new element.

Button Fill

Select several rows in the table and click this button to copy the data from the first row to those following. Entries in the elements column are not copied.

Button Delete

Click this button to delete table values in the selected range.

Display Field Last Change

This field shows the date and time of the last change to the Alloy Grades file.

Button Ok

A click to this button closes the dialog box and stores the altered or newly entered alloy grade data.

Button Cancel

This button closes the dialog box. It cancels the process of changing or entering new alloy grades.

See:

- Dialog Box Alloy Grade Library
- Menu Extras (Measure Window)
- Menu Extras (Program Development)
- Measure Window
- Program Development
- Carry out an Alloy Grade Test

Carry out a Alloy Grade Search
Dialog Box Matching Alloy Grade

9.6.5 Dialog Box Matching Alloy Grade

This dialog box is used for display of found alloy grades in the frame of Carry out an Alloy Grade Search. It opens automatically after finish of the alloy grade search.

List Box Select Alloy Grade

This list box displays found alloy grades.

If more than one alloy grade had been found, the number of the displayed alloy grades depend on the entries in the parameter file. These settings are described in Carry out an Alloy Grade Search. Select a alloy grade from the list and press the buttons Select or Display, see below.

If you perform the alloy grade search in the extended classification procedure KLASSOR, a digit for the degree of agreement is shown behind the name of the alloy grade. This digit defines how precisely the found alloy grades correspond with the analysis. The digit 100 means complete agreement, 0 means no agreement.

Button Previous

Button Next

Click this button to page through several found alloy grades. The button is only shown, if the dialog in the Parameter File is set to the display of only one alloy grade at the same time. Otherwise the found alloy grades are listed in the list box.

Group Box Display Mode

Radio Button Best Alloy Grade / All Alloy Grades

The radio button is only enabled if the extended alloy grade search according to the classification procedure is active. It changes the entry in the parameter file and controls the function of the dialog when it is selected the next time.

Button Cancel

Click this button to close the dialog box.

Button Select

Click this button to import the selected alloy grade from the list box onto the measure window. The limit alloy grade values of each element are displayed above and below their average.

Button Display

Click this button to open the Dialog Box Edit Alloy Grade. Here you may view the alloy grade limits but may not change them.

See:

Measure Window
Carry out an Alloy Grade Search
Dialog Box Alloy Grade List
Dialog Box Edit Alloy Grade
Parameter File

9.6.6 Menu Item Transmit Buffered Data

This menu item allows the transmission of data in buffer storage. Whether the data is to be transmitted directly or first stored in buffer and then transferred using this menu item, can be determined by the user. Use the Dialog Box Output Setup in the Program Development window. Storing to buffer memory is configured by selecting the appropriate options from the Menu Item Transmit in the Menu File of the Measure Window.

See:

- Menu Item Transmit
- Dialog Box Output Setup
- Menu Extras (Measure Window)
- Menu File (Measure Window)
- Measure Window
- Program Development

9.6.7 Dialog Box Edit Password

The dialog box 'Edit Password' is used to change passwords. The dialog box is available for users of access down to level 2. This dialog box is related to menu item Edit Password in menu Extras (Measure window).

The dialog box 'Edit Password' contains the following dialog elements:

Group Box User Name and Level

Name of the the current user and his access level are shown.

Edit Field Current Password:

Enter your current password. This is required to change your password.

Button Check:

After entering your password into the edit field 'Current password' click this button to check the entry. Provided you had entered the password correctly, you may access the edit fields in the group box 'Password'.

Edit Field New Password

Type in your new password. This field is available only when you have entered your current password correctly.

Edit Field Retype Password

Then enter the new password in this edit field again. The repetition shall avoid typing mistakes during the entry which could lead to passwords of unknown shape, even for you.

Button OK

Click the button to shut down the dialog box and to read-in the changed password and user entry respectively.

Button Cancel

Click the button to shut down the dialog box without reading-in in the changed password and user entry respectively.

Remark:

A password must have a length of at least 4 characters.

See:

- Menu Extras (Measure Window)
- Measure Window

9.7 Help Menu

This menu provides help and information about the Spark Analyzer program. The menu is shown in every window. Select one of the following items:

- ➔ **Context**
This menu item allows a display of context related Help text. This may also be activated at any time by using the <F1> function key.
- ➔ **Contents**
This menu item displays the table of contents for the Help system.
- ➔ **Index**
Choose this menu item to activate the search function of the Help system.
- ➔ **Hotkeys**
Choose this menu item for an overview of the hotkey commands.
- ➔ **WEB**
If your spectrometer is connected to the internet, clicking this item will take you to the homepage of SPECTRO Analytical Instruments.
- ➔ **About**
Select this menu item to open the Dialog Box About and display information about the Spark Analyzer program.

See:

Measure Window
Sample Management
Program Development
Scan Manager Monochromator

9.7.1 Dialog Box About

This dialog box provides information about the Spark Analyzer program. The display fields include, for example, the software version number. Click the Button Close to exit this dialog box.

See:

Measure Window
Sample Management
Program Development
Scan Manager
Menu Help

10 Sample Manager

The window for sample management is used to select stored samples results to be displayed. The incorporated sample manager provides fundamental functionality like searching stored samples, display analysis results of selected samples and printout these results. Extended possibilities offer the external programs DIA and DIA-Light which can be purchased from SPECTRO. The sample management may be called up with both, the Menu File in the Measure Window and the Menu File in the Program Development. The window of the sample management opens, which may be opened parallel to the measure window and the window on program development. To switch from one window to another may be effected through the Windows task bar.

Note:

The parameter setting of the data storage for the sample management is done in a Parameter File. The options for parameter setting in the dialog boxes 'Output parameter' and 'Output setup' are not related to the sample management but to a storage of external programs.

Storage of sample results may only be switched on and off. A selective storage of a single sample result is not possible. The storage is carried out after finish the sample measurement and a click on the key F9, **Next sample**. Maximum 19 characters for one sample (sample name) may be entered. But only the first four characters are stored in the result library. To monitor the file size and to prevent from hard disk overflow, the number of stored data files and the size of the files may be checked or a periodical check may be performed. Please take details from the instructions of the parameter file mentioned above.

The sample management window displays the sample list from the result library in a large dialog box. The dialog box contains the following dialog elements:

Group Box Search Criteria

By means of the dialog elements in this group box you may define search criteria for the display of the sample list.

Edit field Program

Enter the name of the Analytic Program for the samples you are looking for. With a click on the button 'Search' the first record is displayed, which matches with the search criteria.

Edit field Name

Enter the name of the Alloy Grade to be searched for. With a click on the button 'Search' the first record is displayed, which matches with the search criteria.

Edit field Date

Enter the date and - if necessary - the time, the display of the sample list shall start with. With a click on the button 'Search' the first record is displayed, which matches with the search criteria.

Combo Box Sample Type

Select from this combo box the sample type, if you do not want a display of all measured samples, independent from the type. With a click on the button 'Search' the first record is displayed, which matches with the search criteria.

Button Search

Click this button to display the first data record which matches the search criteria. If no data record corresponds to the search criteria, a blank list is displayed. This button is only enabled, if the check box 'Automatic search' is not marked.

Check box Automatic Search

Mark the check box, if the search for matching data records should start automatically after input some single name components into the fields of the search criteria. If you do not mark the check box, the search starts after pressing the button 'Search'.

Group Box Sort Criteria

By means of the dialog elements of this group box you may define the sorting criteria for the display of the sample list.

Radio button 1. Program

Select this field if the sample list is to be sorted according to the names of the Analytic Programs. With this sort you may search for a common key 'Program & date entries'. In other words: in case several entries match completely with the criteria 'Program', the start will be defined by the entered date. If the field for the date is blank, the start is the first entry which matches the criterion 'Program'.

Radio button 2. Date

Select this field if the sample list is to be sorted according to the analysis date. Another search criterion cannot be entered, because a definite date cannot exist twice. Each sample result is stored with its unambiguous data and time.

Radio button 3. Sample Name

Select this field if the sample list is to be sorted according to the sample names. With this sort you may search for a common key 'Sample name & date entries'. In other words: in case several entries match completely with the criteria 'Sample name', the start will be defined by the entered date. If the field for the date is blank, the start is the first entry which matches the criterion 'Sample name'.

Radio button 4. Sample Type

Select this field if the sample list is to be sorted according to sample types (unknown sample, standardization sample, calibration sample, control sample...). With this sort you may search for a common key 'Sample type & sample name & date entries'. In other words: in case several entries match completely with the criteria 'Sample type and sample name', the start will be defined by the entered date. If the field for the date is blank, the start is the first entry which matches the criterion 'Sample type and sample name'.

List box Samples

In this field the samples are displayed which are stored in the result library. Updating the list is done automatically after each finished sample measurement. You may select a sample through a click with the mouse or through the arrow keys. The following information on each entry is displayed in the list box: program, first field of sample name, second field of sample name (sample ID 2), date / time of the measurement, sample type (e.g. unknown sample), calculation mode (element concentration, raw intensity,...) data type (single measurement, average value,...), third and fourth field of the sample name (sample ID 3 and 4). With the horizontal scroll bar you may display additional identification features.

By means of the buttons described below you may page between several entries.

Button Close

Click on the button to shut down the dialog box. Simultaneously the window 'Sample management' is closed and the sample management is removed from the Windows task bar.

Button Display

Click on the button to display the stored data of the selected sample. The display is done in the Measure Window, which comes automatically into the foreground. In case the Measure Window contains a non finished analysis, at first the analysis is finished in the same way the button F9 for **Next sample** would be clicked. That means the average value is calculated and the results are printed out, if the parameter setting of the analytic program is done accordingly. To display another sample, switch back to the open window of the sample management by means of the Windows task bar. Now you may select the next sample and click on the button 'Display' again. The button 'Display' is disabled when measurements are carried out in the Measure Window which must not be interrupted. Such measurements are standardization, control sample measurement, calibration.

Button Delete

Click on the button to delete the selected sample. The system prompts you to confirm the message. It is not possible to undo the deletion.

Button Next Page

Click on this button to page down one page. You may use the page keys too.

Button Previous Page

Click on this button to page up one page. You may use the page keys too.

Button Start of File

Click on this button to bring the visible part of the sample list to the beginning of the file. You may call-up this function through pressing the key <Pos1>.

Button End of File

Click on this button to bring the visible part of the sample list to the end of the file. You may call-up this function through pressing the key <Pos1>.

See:

- Measure Window
- Program Development
- Parameter File

11 Program Development


The program development window is used for definition of parameters on Analytical Programs and for regression calculation on calibration. In case the window for program development is called, the menu listed below are shown:

- ➔ Menu File
- ➔ Menu Edit
- ➔ Menu Instrument
- ➔ Menu Extras
- ➔ Menu Help

The window for program development does not contain further dialog elements.

11.1 Menu File (Program Development)

This menu is used to open and activate windows, to call file and print operations and to exit the program. The menu is shown in each window. Especially in Program-Development the following menu items are available:

- ➔ **New Program**
Select this menu item to open Dialog Box New Program/Save As and to create a new program.
- ➔ **Load Program**
Select this menu item to open Dialog Box Load Program and to load an existing Analytical Program.
- ➔ **Save**
Select Menu Item Save to save changes of the currently loaded Analytical Program.
- ➔ **Save As**
Select this menu item to open Dialog Box Save As and to save the currently loaded Analytical Program under another file name.
- ➔ **Delete**
Select Menu Item Delete to delete the currently loaded program.
- ➔ **Calibration**
Select this menu item to move directly to Measure Window to measure calibration samples of the Analytical Program selected. This menu item is actuated by pressing the <F11> key too.
- ➔ **Measure Window**
Select this menu item to move directly to Measure Window to measure production samples with the Analytical Program selected. This menu item is actuated by pressing the <F12> key too.
- ➔ **Scan Manager**
 Select this menu item to switch over to the window of Scan Manager Monochromator. The scan manager is called-up as independent program part, like e.g. the program development. If you want to use the scan manager for integrating monochromator lines into an analytical program, you may call-up the scan manager through the Dialog Box Channel Parameter in the window on Program

Development. You may enable this menu item with the key combination <Ctrl>+<F12> too.



On a SPECTROLAB Jr. CCD, choose this menu item to switch over to the application window of Scan Manager CCD. The scan manager CCD is called-up as independent program part, like e.g. the program development.

➔ **Sample Manager**

Select this menu item to move to the window of the Sample Manager. This menu item is actuated with the <Alt>+<F12> key combination too.

➔ **Layout**

Select this menu item to open Dialog Box Layout. In this dialog box you can configure the presettings on the print-out of the local printer.

➔ **Printer Setup**

Select this menu item to open Dialog Box Printer Setup. In this menu item you can define, and resp. configure the local printer.

➔ **Print Program**

Select Menu Item Print Program to print out the data of the current Analytical Program.

➔ **Exit**

Select Menu Item Exit to exit the program development. This menu item is also called by pressing the <Alt>+<F4> key combination.

See:

Program Development
Menu File (Measure Window)

11.1.1 Dialog Box New Program/Save As

This dialog box is used to generate a new Analytical Program and to save an already existing Analytical Program under another file name. Saving under another name would provide an advantage if program parameter are to be modified as a trial. To retrieve the original unchanged program is consequently possible without great efforts.

Combo Box Base

Select the Base in this combo box which belongs to the Analytical Program. Depending on the equipment of your instrument one or more bases are available.

Edit Field Program name

Fill in the name under which the program shall be saved. The size of the name is max. 30 characters. Please note that a program name shall be unambiguous. In other words the name selected shall not exist another time. When quitting the program a check is performed to clear whether the new name already exists. In that case an error message is displayed. Please enter another file name.

Edit Field Program author

Enter your name or your initial; by means of this everybody can be identified who worked on an Analytical Program.

Display Field Create date

In this field the date of creation of the method is indicated. In case you are just generating a new method the actual date is indicated.

Display Field Last change

In this field the date of the last modification of the method is indicated. When you are just performing a change (change of file name or creation of a new program) the actual date is displayed.

Button OK

Click the button to close the dialog box and to read-in the input.

Button Cancel

Click this button to close the dialog box. The routine to create or save under another name is canceled. The input is not read-in.

See:

Program Development

Menu File

11.1.2 Menu Item Save

By means of menu item **Save** an Analytical Program is saved. Saving is always necessary if an Analytical Program was edited and the modifications shall be permanent.

In case another Analytical Program is loaded or Program Development is quit without selecting the menu item Save, a warning will be displayed. Simultaneously you can save all changes now. If you do not save, all the changes are lost irretrievably.

Note:

Unintentional or unqualified changes in existing Analytical Programs may spoil the reliability of analytic results. In case parameter of measure sequence and evaluation were changed, we recommend you to save programs under another file name. The original program can be retrieved easily.

See:

Program Development

Menu File

Dialog Box New Program/Save As...

11.1.3 Menu Item Delete (Program Development)

By means of menu item **Delete** the loaded Analytical Program is deleted. This function should be used only in particular situations. You should not delete any program which are part of the equipment of the spectrometer.

Before deleting the program an inquiry is effected whether you really want to delete the file. Only if you confirm this question the deletion will be effected. In case you are uncertain about a later need of an Analytical Program to be deleted, you can export the Analytical Program firstly. Exported Analytical Programs can be re-imported after deletion. The resp. menu items 'Import Programs' and 'Export Programs' are listed in the menu Extras.

After deleting a loaded Analytical Program, all the menu items of the program development are disabled which require a loaded Analytical Program. Load or generate another Analytical Program when required.

See:

- Program Development
- Menu File
- Export Program
- Import Program

11.1.4 Menu Item Print Program

Select this menu item to print all important data of the loaded Analytical Program. Depending on the size of the Analytical Program the print out may cover several pages.

See:

- Program Development
- Menu File

11.2 Menu Edit (Program Developement)

This menu is used to edit parameters of the currently loaded Analytical Program. The menu is displayed in the window of the Program Development. The following menu items are available:

- ➔ **Global Parameters**
Select this menu item to open the Dialog Box Global Parameters and to set parameter values for the Analytical Program.
- ➔ **Source parameters**
Select this menu item to open the Dialog Box Source Parameters and to adjust the source parameters for the Analytical Program.
- ➔ **Element Parameters**
Select this menu item to open the Dialog Box Element Parameters and to edit the parameters of the elements.
- ➔ **Channel Parameters**
Select this menu item to open the Dialog Box Channel Parameters and to set the channels with its parameters.
You also may call-up from this dialog box the Scan Manager, if you want to genereate an analytical program containing monochromator lines.
- ➔ **Element Format**
Select this menu item to open the Dialog Box Element Format and to define the sequence and both, the formatting of elements and the affiliated analysis results.
- ➔ **Output Parameters**
Select this menu item to open the Dialog Box Output Parameters and to enter the parameters for automatic output of analysis results.
- ➔ **Auto Aver. Parameters**
Select this menu item to open the Dialog Box Auto Aver. Parameters.
- ➔ **Calibration Ranges**
Select this menu item to open the Dialog Box Calibration Ranges and to check the determined calibration ranges.

→ **Calibration Standards**

Select this menu item to open the Dialog Box Calibration Standards and to define the Standard Samples to carry out a Calibration.

→ **Global Interferences**

Select this menu item to open the Dialog Box Global Interferences and to define the well-known interference variables (Interferences).

→ **Regression**

Select this menu item to open the window to carry out a Regression. Carrying out a regression the Calibration Data for the selected Analytical Program are calculated.

→ **Standardization Samples**

Select this menu item to open the Dialog Box Standardization Samples and to define Standard Samples to carry out a Standardization.

→ **Standardization Parameters**

Select this menu item to open the Dialog Box Standardization Parameters and to check the data of the last effected Standardization.

→ **Control Samples**

Select this menu item to open the Dialog Box Control Samples and to define Standard Samples to carry out a Control Sample Test.

→ **Type Calibration Samples**

Select this menu item to open the Dialog Box Type Calibration Samples and to define Standard Samples to carry out a Type Calibration.

→ **Type Standardization Samples**

Select this menu item to open the Dialog Box Type Standardization Samples to define the Standard Samples to carry out a Type Standardization.

→ **Copy Line**

Select this menu item to open the Dialog Box Copy Line and to copy the data of a line.

See:

Program Development

11.2.1 Dialog Box Global Parameters

The dialog box Global Parameters is used to set up the values on global features of the Analytical Program. The dialog box is opened with the menu item **Global Parameters** in the Menu Edit of the Program Development. The box contains the following dialog elements:

Group Box Global Settings

This group box shows general data of the Analytical Program loaded and gives the possibility to edit the data.

Edit Field Program Name

This edit field displays the name of the Analytical Program selected. The Analytical Program is loaded in the moment of the dialog call; consequently the edit field is disabled and changes are not possible. Renaming the Analytical Program is not possible too. Using the menu item Save As... an existing Analytical Program can be saved under another name.

Combo Box Base Element

This combo box displays the Base the program belongs to. The base element is defined in the moment of program generation, because it is firmly linked with the Analytical Program. Consequently no changes are possible in this field.

Combo Box Alloy Group

By means of this combo box you can select the Alloy Group which shall be covered by the Analytical Program. This entry is mostly for your information and is a distinctive mark on the manual program selection. This entry has no influence on the internal program run and calculation algorithms.

Edit Field Author

This field displays the name or the initials of the program author. In case you modify an Analytical Program you should enter your name here. So it is always comprehensible who modified the program.

Edit Field Comments

You can enter comments in this field up to a size of 255 characters. The comment may contain e.g. information about the application range of the Analytical Program or notes about special sample preparation.

Group Box Optional Settings

This group box contains the program features which are connected with the measurement course, evaluation, output.

Check Box Orientation Program

By means of this box you define this program as an Orientation Program. Exactly one orientation program per single base can exist. With the analysis of an orientation program another Analytical Program of the same Base can be branched, provided that the check box 'Automatic Program Selection' is enabled.

Check Box Global Standardization Program

By means of this box you define this program as a 'Global Standardization Program'. Exactly one global standardization program per single base can exist. Further Analytical Programs of a base which shall be standardized with the Global Standardization have to be derived from the global standardization program. This can be done by saving the program under another name in the menu item Save As...

Check Box Automatic Program Selection

By means of this box you decide whether you want to carry out an Automatic Program Selection. This check box is enabled on the condition that the Analytical Program to be edited is an orientation program.

The first measurement of a production sample is evaluated by means of the calibration data of the loaded orientation program. The concentrations determined are compared with the calibration ranges of the other Analytical Programs of the same base and the fitting program is loaded automatically. Further measurements of this production sample are effected with the selected Analytical Program.

Check Box Load Orientation Program Automatically

By means of this box you decide whether the orientation program will be reloaded after performing a analysis of a production sample. This check box provides an option for cases the edited Analytical Program is **not** an orientation program. This option is connective with the automatic program selection.

Check Box Use Type Calibration

By means of this box you set the program to work with Type Calibration. This is recommended if you should use just one global calibrated Analytical Program for several alloy groups. This global calibrated program is prepared by the manufacturer, depending on the specification of the spectrometer system. During the first measurement of a production sample the system searches for fitting type calibration samples which are stored. The next step is to load the type calibration for the elements which are defined in the type calibration samples automatically. Based on these type calibration values the analysis is converted and put out. All further measurements of the respective production sample are converted directly based on the loaded type calibration.

Check Box Alloy Grade Test

By means of this box you decide whether a comparison with alloy-grade-content-presets is carried out during output of analysis results. This alloy grade test is only possible on condition that in Sample Identification information an alloy grade-type field has been defined. The alloy grade test name must be entered into the sample identification field manually or by means of a user task. The result of the alloy grade check is shown in different colors for each element. In case of exceeding the limit values, the sign '+' or '-' is added to the element symbol.

Check Box Auto Average

By means of this box you decide whether the spectrometer program should carry out an automatic averaging after a preset number of single measurements. Here a special function for detection and elimination of deviating values may take effect. The settings for automatic averaging are done in the Dialog Box Auto Aver. Parameters. Here you may find a description of this function.

Check Box Standardize Globally

By means of this check box you define whether the current program shall be standardized through a global standardization.

Combo Box Matrix Calculation

Here you control the kind of the matrix calculation. The usual entry is 'standard'. The contents of all analyzed elements are summed-up and subtracted from 100%. This value is regarded as matrix rest content and is incorporated into the calculation of the matrix-corrected concentration.

There is another procedure of calculating the matrix when it comes to special applications. In some countries there are regulations how to calculate the matrix content. This procedure is of special interest when pure metals are to be produced: here the content of the matrix element is decisive. A procedure exists which defines the kind of calculating the content of Al in pure aluminum as follows:

Sum-up only the contents of elements which exceed a defined value, e.g. 0.001.

Round up the analysis values to a defined full number, e.g. 3.

Calculate the matrix content by subtracting this sum from 100%.

The screen and printer output is not influenced by this definition of the number of fractional digits. If you want to complete the matrix calculation according to this procedure, you have to set the parameters in the Parameter File PS_GEN.ASC. In this dialog you can select the kind of matrix calculation.

Radio Buttons Argon and Ar+H2 resp.

By means of the two radio buttons you define whether pure argon (Ar) (spectrometer quality 4.8) or argon-hydrogen (Ar+H2) is used for the Analytical Program. Using argon-hydrogen, the content of hydrogen shall be 2%. These buttons are just for information. The selection of one of the buttons does not control any valves and has no influence on the analysis.



These radio buttons are not available with SPECTROLAB Jr. CCD.

Button OK

Click the button to shut down the dialog box and to read-in the modified inputs for the global parameters into the Analytical Program.

Button Cancel




Click the button to shut down the dialog box without reading-in the modified inputs for the global parameters into the Analytical Program.

See:

- Program Development
- Menu Edit
- Carry out an Alloy Grade Test

11.2.2 Dialog Box Source Parameters

This dialog box is used to enter the Source Parameters which are used for the current analytical program. You must not change source parameters during calibration of the analytical program. A change of source parameters after calibration may result in faulty analyses.

The following description applies for the types SPECTROLAB  and SPECTROCAST . If you work with a SPECTROLAB jr CCD , you find explanations at the very end of this chapter.

The dialog box contains the following dialog elements:






SPECTROLAB , SPECTROCAST

Table Field Source Parameters

In the table field Edit Source Parameters the source parameters for the different measurement cycles are set. The table contains the following columns:

Column Field Cycle

Select the measurement cycle in this cell. There are measurement cycles for several source parameters as well as cycles without any source. The following measurement cycles can be selected:

	---	Source not enabled
	ARC	Arc excitation, low detection limit
	SAFT	Special signal evaluation, used for increased detection sensitivity. Only possible for channels equipped with additional SAFT hardware.
	Sparc1,2,3	Spark excitation for better general reproducibility than arc excitation
	PreSpk1,2	Prespark to remelt and to homogenize the focus spot
	Flush	Source is disabled, spark stand is flushed with Ar or argon-hydrogen
	Delay	Delay, source is switched off for short
	PIMS	Measurement cycle for PIMS - analysis
	Calc	Concentrations are calculated in this cycle, the source unit is enabled
	Dark	Determination of arc current of sensors in this cycle, source unit is disabled during the cycle

The entries marked with **LAB** are only available if you are working with a SPECTROLAB.

CAST SPECTROCAST is featured by the following specialties:

Measurement cycles spark1,2,3 do not characterize different source parameters, but represent 3 shutter positions for measurement of 3 analytic lines per light detector.

A typical measurement cycle looks like: at first flushing for several seconds, followed by PreSparking and different source conditions for integration. The source conditions may contain several spark and as-arc discharges and PIMS, SEREPS, SAFT-measurement conditions optionally.

Column Field Time (s)

Enter the measurement time for the resp. measurement cycles in this edit field.

The following column fields are visible in case that the **Radio Button Source Parameters** on the bottom of the dialog is marked.

LAB Column Field C (μ F), R (Ohm), L (μ H)

The Source Generator is an electric oscillator to be controlled with adjustable capacitors, resistors and inductors. Set the values on capacity, resistance and inductance for each measurement cycle in the combo boxes.

Column Field Freq (Hz)

Select the source frequency for the different measurement cycles in these combo boxes.

LAB Column Field Ar

Define by means of this column field the gas flow on flushing during the measurement cycle: high flow (A = Analytic Flow) or low Ar-flow (C = Constant Flow).

Column Field SSE

This column is only visible if you have marked the field SSE in the Dialog Box Additional Devices. Mark this field if the measure cycle should work with single spark evaluation.

LAB Column Field Mask

Define by means of this column field whether during some particular measuring cycles a definite range of light is to be masked mechanically. To analyze some particular elements this may be advantageous.

LAB Column Field Integr

Define by means of this column field whether a measurement cycle for concentration determination shall be used. E.g. the cycle PreSpark does not contain such a measurement cycle.

Column Field Shutter

Define by means of this column field whether a Shutter in the light path shall be open during the measurement cycle. A mark in this field indicates the Shutter is open. An open Shutter is always needed to evaluate the light signal. An open Shutter is necessary for all analytic measurement cycles. In case of PreSpark only SEREPS or SATEUS is enabled.

Column Field SEREPS

Click the field if the pre spark time should not stick to a fixed value but should control itself automatically depending on the behavior of the sample.

Column Field Bad Smp Det

Click the field if a bad sample shall be determined. This field has to be marked using SATEUS or SETEME.

The following column fields are visible on condition that the **Radio Button Spark control** on the bottom part of the dialog box is marked.