NITON XL3t 700 Series Analyzer

User's Guide

Version 6.4

Thermo SCIENTIFIC

Contents

About This User's Guide

WARNING! Do not attempt to use this analyzer without first reading and understanding the entire User's Guide! ♦

CAUTION NITON Analyzers are not intrinsically safe analyzers in regard to sparking. All pertinent Hot Work procedures should be followed in areas of concern. ♦

Unpacking and Assembling Your NITON XRF Analyzer

- Inspect the shipping carton for signs of damage such as crushed or water damaged packaging. Immediately notify the shipping company and Thermo Fisher Scientific, in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, if there is any visible damage to the shipping container or any of its contents.
- Open the packing carton. If your analyzer is not packed in its carrying case, please call Thermo Fisher Scientific immediately, in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460.
- Verify the contents of the shipping container against the enclosed packing list. If there are any discrepancies between the actual contents of the shipping container and the enclosed packing list, please notify Thermo Fisher Scientific immediately, in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460.
- Open the carrying case and visually inspect the analyzer for damage before removing it from the case. Call the shipper and Thermo Fisher Scientific if you find any damage to the case or its contents.
- Save the shipping carton and all packing materials. Store them in a safe, dry area for reuse the next time that you ship the analyzer.

The NITON XRF Analyzer Overview

The NITON XL3 Analyzer is a single unit, hand held, high performance portable x-ray fluorescence (XRF) elemental analyzer.

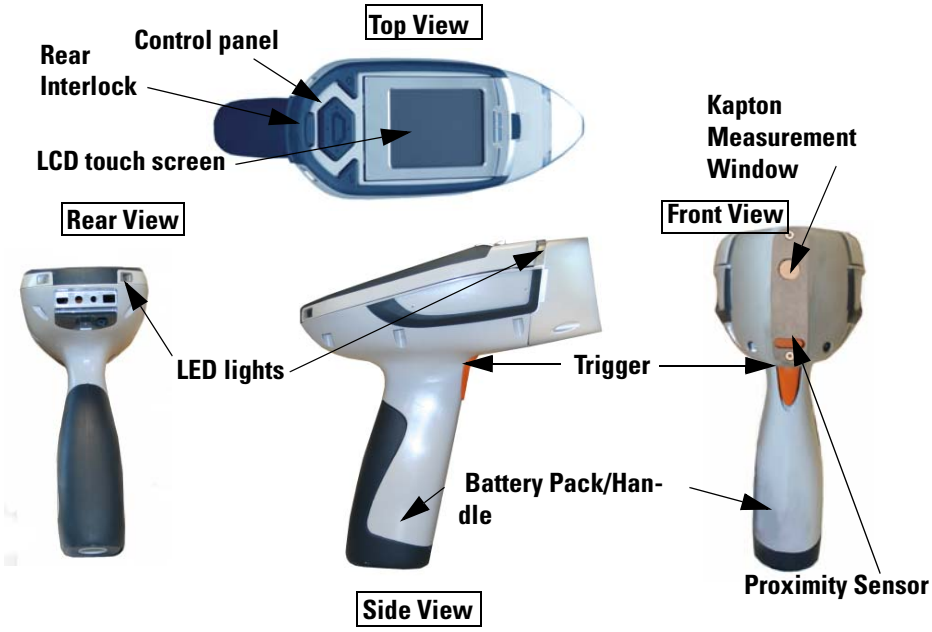

Figure 0-1. Analyzer Overview

The Control Panel

The control panel is located on the analyzer's top housing, directly below the LCD touch screen (see Figure 0-1). The control panel consists of a 4 way touch pad, a center button, and two control buttons, one on each side. Using either the control panel or the touch screen you may navigate through all of the analyzer's screens and menus. You can control the movement of the screen cursor by pressing the four way control pad in one of four directions to highlight each of the menu options. The Select button in the center of the four way touch pad is used to select highlighted menu options. The on/off/escape button both controls the power to the analyzer and serves as an "escape" button. When the on/off/escape button is pushed and immediately released, it functions as an "escape", and brings you back to the Main Menu from the current screen in the menu system.

Figure 0-2. The Control Panel

Push and hold the on/off/escape button for at least 3 seconds to turn the analyzer on.Push the on/off/escape button and hold it down for about 10 seconds to shut off power to the analyzer from any screen in the menu system.

You also have the option of operating the analyzer, including navigating the menu system, by using the built in touch screen. To select a menu option, tap on the icon once. The touch screen icons have the same functionality as the four way touch pad, the on/off/escape button, and the select or enter button. This User's Guide will refer to the process of choosing a course of action by selecting an icon from a menu, either using the touch screen or using the control panel buttons, as “selecting.”

Selecting the **Return** icon works everywhere throughout the User Interface to bring you back to the previous menu from the current menu in the menu system. Use the on/off/escape button to return to the **Main Menu**.

The LCD Touch Screen

The LCD Touch Screen on your XL3 Analyzer is designed to swing up and down to different angles for ease in viewing and interacting with your analyzer. The LCD Touch Screen is connected to your analyzer along the base of the screen, right above the Control panel. The screen is not designed to separate from the analyzer, but can be adjusted to any arbitrary angle between zero degrees - that is, flush with the analyzer - and 85 degrees, which is almost perpendicular. The LCD Touch Screen will stay at any given angle between these extremes until moved to a different angle. When in closed position, the screen is secured by a catch at the top center of the screen housing.

Figure 0-3. XL3 Analyzer Showing LCD Screen Tilted.

- To raise the LCD Touch Screen, disengage the catch at the top-center of the LCD Touch Screen housing and gently pull the screen towards you until it is at the best angle for your use.

- To close the LCD Touch Screen, gently push away from you along the top edge of the screen housing. The screen will swing down until the catch solidly engages with an audible click.

Note The LCD Touch Screen cannot be removed from your XL3 analyzer. Removing or attempting to remove the LCD Touch Screen will damage your analyzer and void your warranty.

Note Always close your LCD Touch Screen before storing or transporting your XL3 analyzer.

The Data Ports

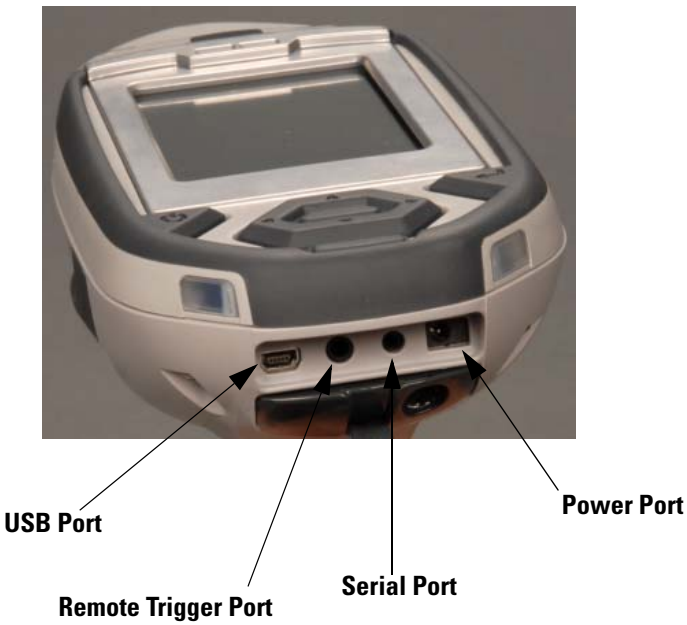

Figure 0-4. Data Ports on the XL3

USB Port The USB Port is a communications and control port, for uploading and downloading data, configuration files, and software to the analyzer.

Remote Trigger Port The Remote Trigger Port controls the analyzer's trigger function, for use with the Extend-a-pole, In Situ Tripod, and test stands.

Serial Port The Serial Port is a communications and control port, for uploading and downloading data, configuration files, and software to the analyzer.

Power Port The power port is used to run the XL3 under external power.

Instrument Startup

To turn on the analyzer, depress the **on/off/escape** button on the control panel for approximately 10 seconds.

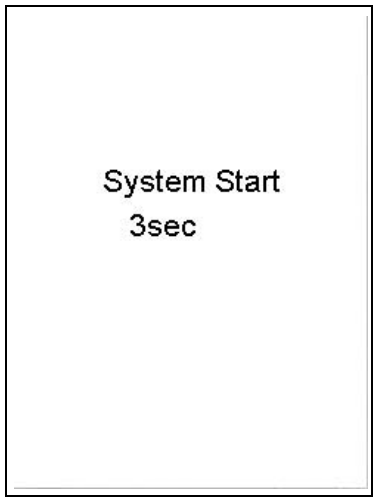

Figure 0-5. System Start Screen

On startup, the screen will be replaced by a **Start Screen** (see Figure 0-5) which will automatically count down from 9 to 0 in increments of one second.

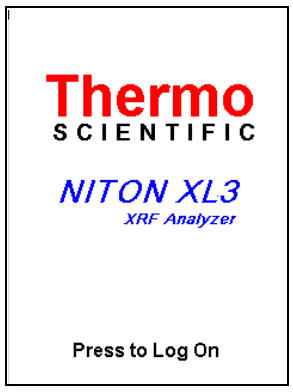

Figure 0-6. Logon Screen

When the Start is complete, the Start Screen will be replaced by the Logon screen (see Figure 0-6.) Tap anywhere on this screen to continue.

The Logon Screen will be replaced by a Warning Screen, see Figure 0-7, advising you that this analyzer produces radiation when the lights are flashing. You must acknowledge this warning by selecting the “Yes” button before logging on. Selecting the “No” button will return you to the Logon Screen.

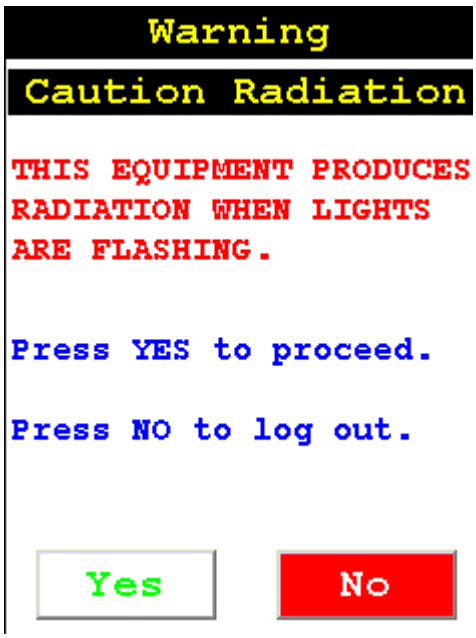

Figure 0-7. Warning Screen

After selecting the "Yes" button, the Virtual Numeric Keypad becomes available for you to log onto the analyzer.

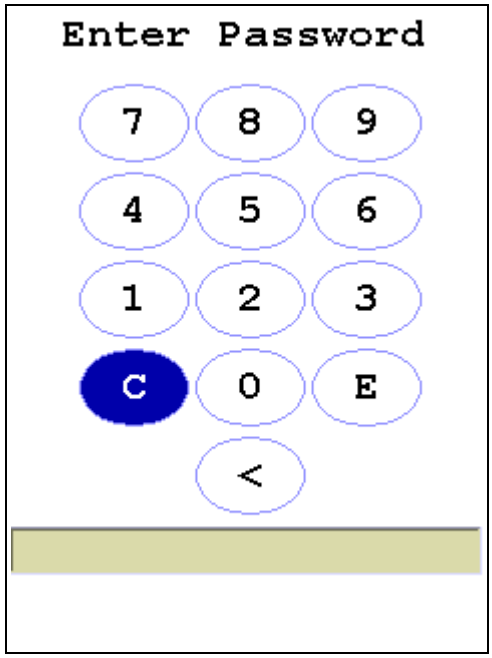

Figure 0-8. Virtual Numeric Keypad for Logon

Select your 4 digit security code, followed by the enter (E) key. The temporary password assigned by default is 1-2-3-4, followed by the “E” key. If you enter an incorrect number, you can use the “<“ key to backspace over it, ot use the “C” key to clear everything. After you have completed the log on procedure, the word "USER" will appear on the bottom of the screen, then the Main Menu will appear. Note that security codes are editable. Please see the NDT manual for instructions on creating user-definable passwords.

Check the date/time. The time should be set correctly for accurate and verifiable record keeping (See Chapter 1 page 92).

Your analyzer can be stored and operated safely in temperatures from -10º C (14º F) to 50º C (122º F). You will not be able to take a measurement if the analyzer overheats. If it is hot to the touch, you should allow it to cool before testing.

The NAV Menu

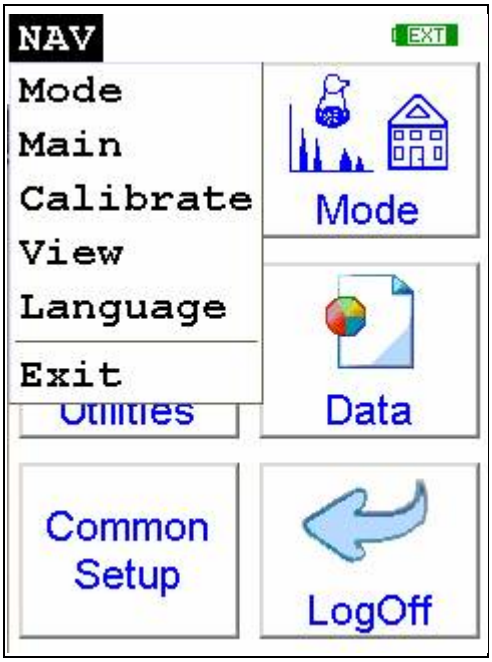

Figure 0-9. The NAV Menu

The Navigation Menu, or NAV Menu, is available in all screens, though only through the touch screen interface. Within a menu, the particular options available from the NAV Menu may change with the context. For example, within the View Menu, the NAV Menu changes options depending on the mode you are currently using.

Access the NAV Menu by selecting the word NAV in the screen. A drop-down menu of choices will appear. Selecting an option from the NAV Menu will take you directly to a particular menu, no matter where you are in the menu hierarchy. Selecting the "View" option from the NAV Menu, for example, will bring you directly to the Data Menu.

The NAV Menu cannot be selected through the Control Panel.

The Battery Life Indicator

The Battery Life Indicator is visible on all screens in the menu system. The indicator is visible in the top right portion of the screen, and graphically shows you how much battery life is left, enabling you to change batteries as needed to avoid unexpected shutdowns.

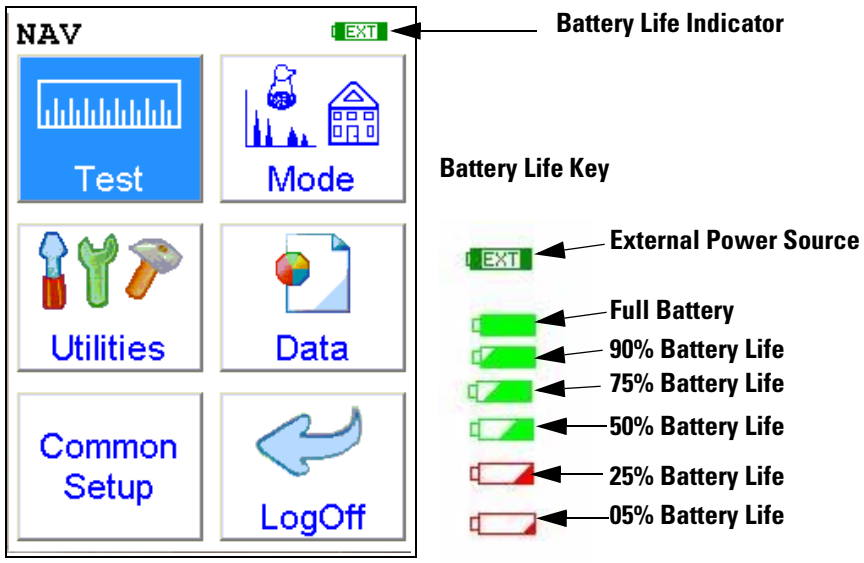

Figure 0-10. Battery Life Indicator

The more green visible in the indicator, the higher the charge. The more red visible in the indicator, the lower the charge. It's best to charge one battery while using the other, to avoid work slowdowns or stoppages due to battery charge conditions.

WARNING! In the highly unlikely event that the x-ray tube remains on when the trigger is not depressed, disconnect the battery pack immediately to turn off the x-ray tube, and call Thermo Fisher Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States at +1-978-670-7460, or your local Authorized NITON Analyzers Service Center. ♦

The Menu Path

The Menu Path shows you graphically how to get to the function being described in several discrete steps from the universal start position, the Main Menu.

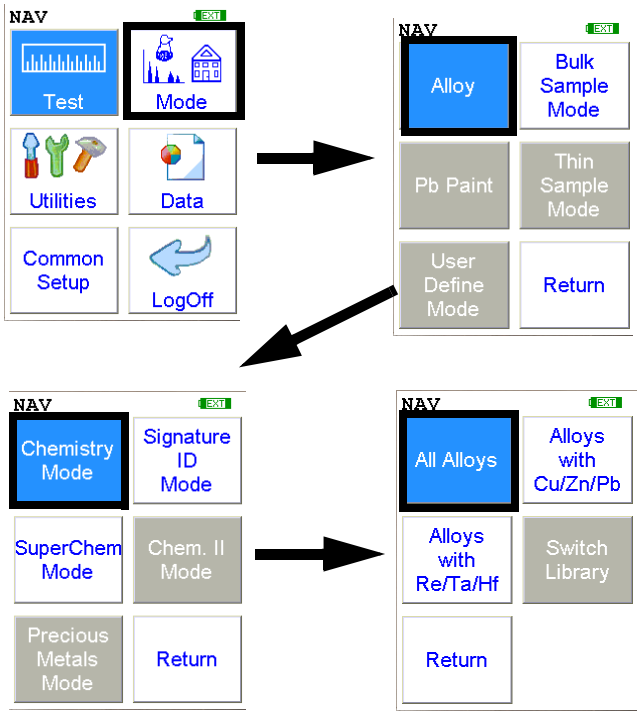

Figure 0-11. Example Menu Path

In the Menu Path, the order is top to bottom, then if needed left to right, starting with the Main Menu and ending with the function wanted. The arrows show the succession of menus, while the icon to be selected is highlighted by a heavy rectangular border.

This Menu path should be read as:

> To get to this screen, starting at the Main Menu, select the Mode icon, select the Alloy icon, select the Chemistry icon, then select the All Alloys icon.

Chapter 1 Applications

The NAV Menu

The **NAV Menu** enables you to move between various menus and screens directly, without going through the intervening screens. Select a destination from the drop down menu and you will be brought directly to that menu or screen.

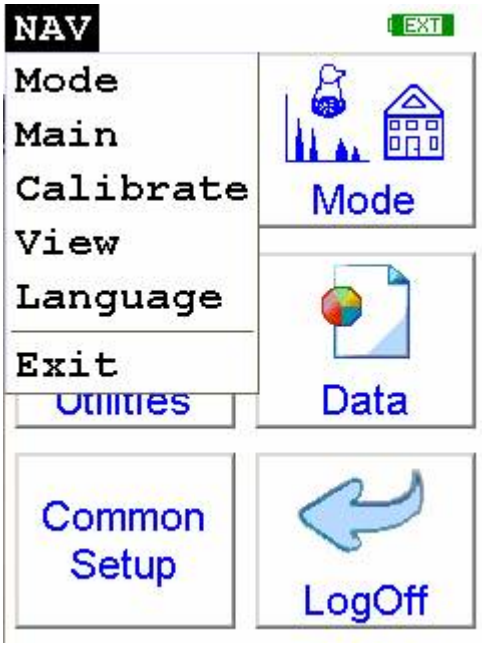

Figure 1-1. The NAV Menu

The Tools Menu

The **Tools Menu** enables you to perform common data-related tasks such as printing and averaging. Select a task from the drop down menu to initiate that task.

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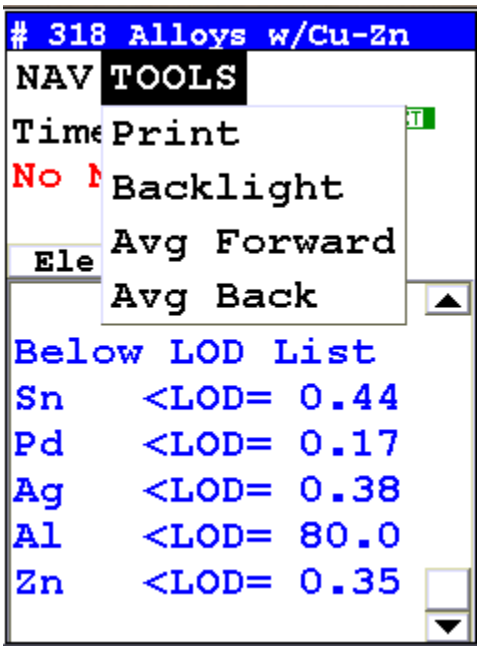


Figure 1-2. The Tools Menu

The Tools Menu, like the NAV Menu, uses context sensitive menus. The following is the most common menu set.

Print

Enables you to print the sample analysis to the optional printer.

Backlight

Enables you to turn backlighting on and off.

Avg Forward

Enables you to average different readings together from this analysis forward. Select **Avg Forward** to initiate future sample averaging. **Avg Forward** will set up an automatic personal averaging protocol to be followed until your analyzer is shut down, or this feature is disabled. To begin, select the number of readings you want to average from the virtual numeric keypad. Your analyzer will calculate an average reading after that number of tests, and continue this pattern until stopped. For example, if you select 3 on the virtual keypad, the analyzer will automatically calculate, average, and store a reading for every three tests you take, storing the individual readings along the way.

Avg Back

Enables you to average different readings together from this analysis backward. Select **Avg Back** to initiate backwards sample averaging. **Avg Back** will take a number of readings you select and average their analytical results. The range is counted from the last reading backward by the number of readings selected. If your last reading was #15, selecting 3 would average readings #13, 14, and 15. The average is calculated, displayed, and stored into memory as the next sequential reading number.

The range number is selected using a virtual keypad on your analyzer similar to the keypad used for login. Select the digits in the range number from the keypad, then select the "E" key to enter the number. "C" will clear all, and "<" will clear the last digit entered. The average will automatically be displayed.

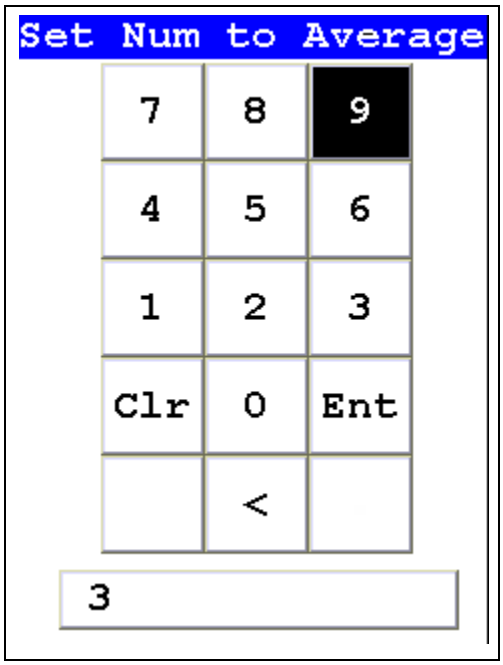


Figure 1-3. The Virtual Numeric Keypad for Averaging

Note You cannot average readings taken with different element lists - or with different filter settings if the settings have different element lists - with either **Avg Back** or **Avg Forward**. Alloy and Mining modes each use the same element lists with the different filter settings, so averaging works when switching between filter settings when in either of these modes. Thin Film and Bulk modes both use different element lists for different filter settings, and readings with different filter settings cannot be averaged when using either of these modes. You can never average readings taken in different modes.♦

Note The **Tools Menu** is only available when viewing readings, and the menu is only accessible through the touch screen interface or NDTr. ♦

Stop Avg Fwd/Back

Avg Back and Avg Forward are toggles. The option on the Tools Menu changes to its opposite when selected. To stop averaging, select Stop Avg Fwd or Stop Avg Back from the Tools Menu as appropriate.

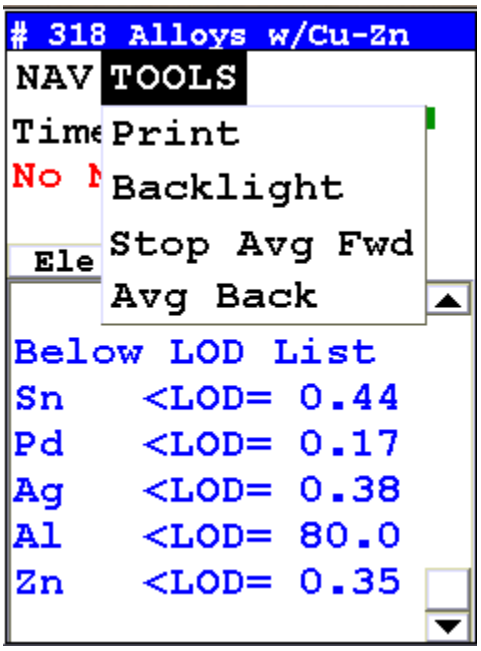


Figure 1-4. The Tools Menu - Averaging Toggles

Example Averaging

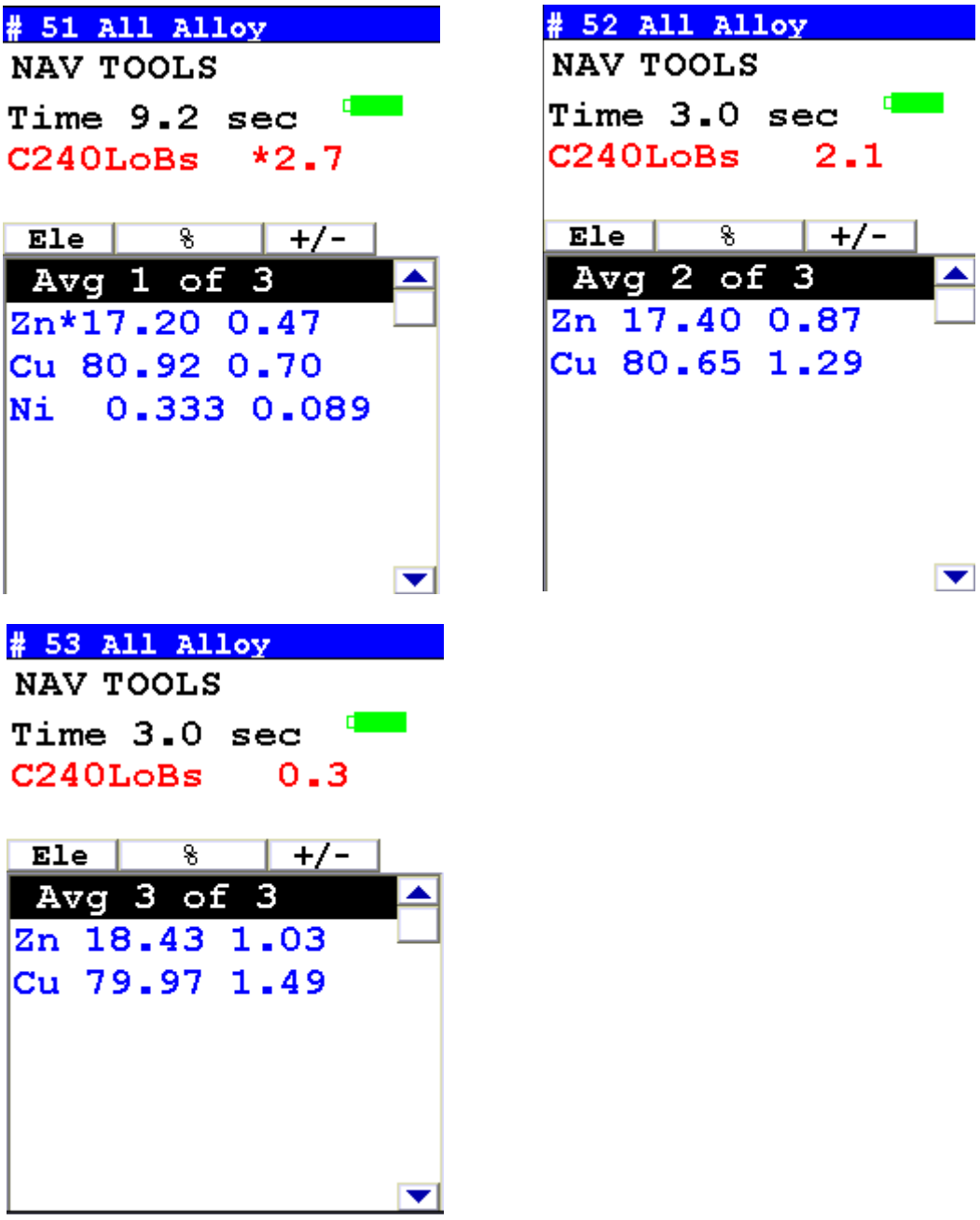


Figure 1-5. Averaging example: 3 readings

Live Spectrum Feed

The Tools Menu may contain a toggle option to display live spectra as sample analysis occurs.

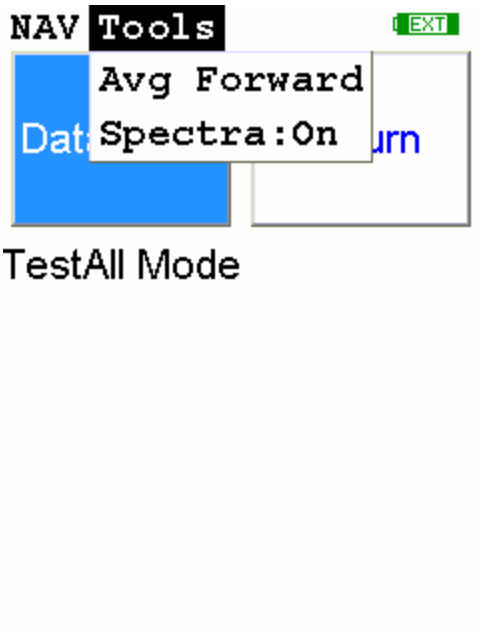


Figure 1-6. The Tools Menu showing the Spectra On/Off Toggle

Activating and Deactivating the Live Spectrum

From the Tools Menu, select Spectra : On to turn the Spectrun feed on. Once the spectrum is displayed, selecting Spectra : Off from the Tools Menu will stop the live spectrum display.

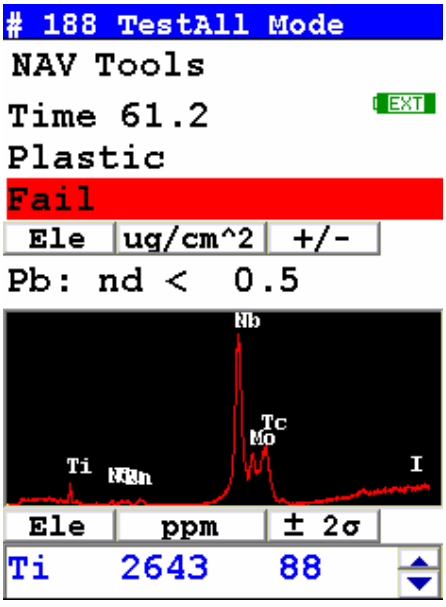


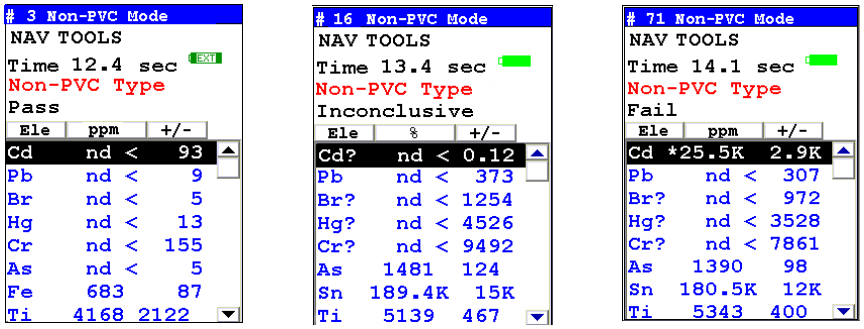
Figure 1-7. Test Screen Showing Live Spectrum

RoHS Compliance

RoHS Operating Procedure

Please review the Standard Operating Procedures (SOP) included with your analyzer. The SOP includes the most current instructions for RoHS and WEEE analysis with your NITON analyzer.

If you have had your analyzer for some time, the most recent RoHS Standard Operating Procedures for NITON analyers are available from Thermo Scientific upon request. For more information on this document, please contact Thermo Scientific's Customer Service Department in the United States, Toll free, at (800) 875-1578, or outside the United States at + 1-978-670-7460, or your authorized NITON Analyzer Service Center.



#1

Pass:

Compliant for all RoHS Elements.

Note that low Fail limits may require longer testing times to establish compliance.

#2

Inconclusive:

The results for Br, Hg, and Cr are not yet conclusive. Longer testing times may be needed.

#3

Fail:

Noncompliant levels of Cd.

Figure 1-1. RoHS Testing Screens

Interpreting the symbols on-screen.

a. An asterisk (e.g. Cd*) indicates that the element concentration minus the uncertainty is higher than the Fail limit.

b. A question mark (e.g. Cd?) means that the element concentration in question is inconclusive, i.e. between the user-defined Pass and Fail limits. (Please refer to the User Manual for instruction on changing

pass/Fail Limits). In some cases, the question mark indicates that a longer analysis time is required to determine whether or not that element passes or fails the RoHS limits.

c. An element symbol not denoted with either an asterisk or a question mark (e.g. Cd) means the concentration of the element plus the uncertainty is lower than the Pass limit. Please refer to the chart on page ten for further information concerning Pass / Fail / Inconclusive results.

1. **The results screen displays analytical results for detected (i.e. above detection limit) and non-detected (i.e. below detection limit) elements. (See Measurement Time section for an explanation of statistical precision and detection limits.) The five RoHS elements are always listed first on the screen, whether they have been detected or not. Note that a RoHS element not detected above a reading's detection limit is listed as "ND < XXX" where XXX is the three standard deviation detection limit. A complete list of elements measured during a reading can be viewed by scrolling down the display using the down arrow button. Refer to the release notes for instructions how to alter the element display screen.**

Plastics Analysis Mode

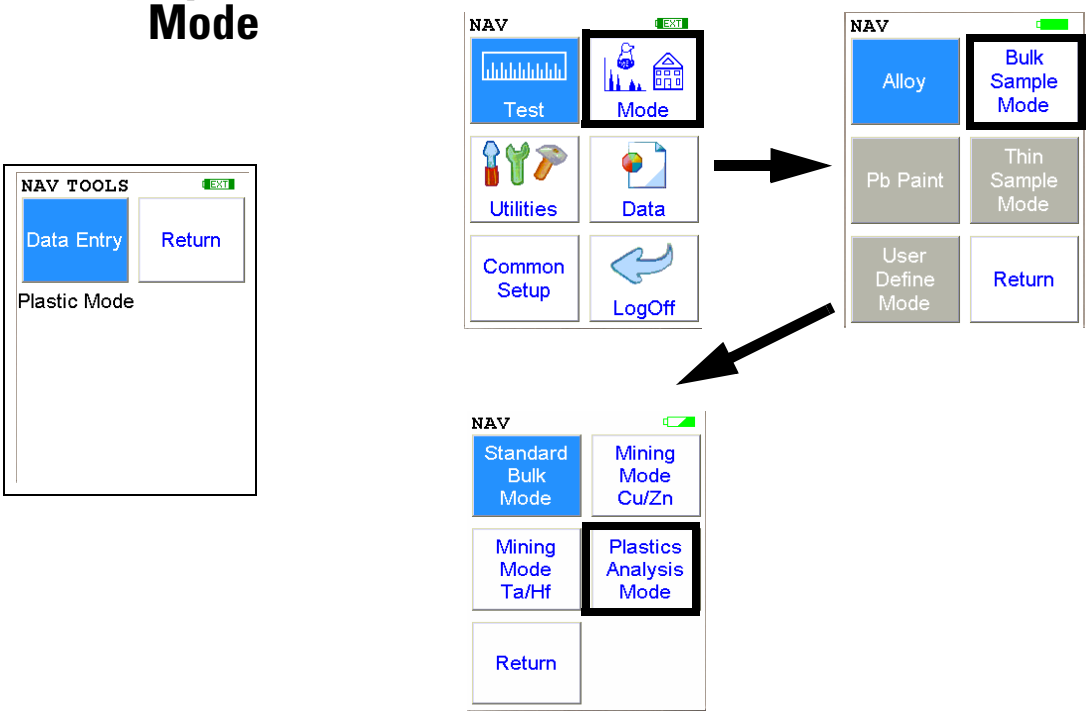


Figure 1-2. Plastics Analysis Mode

The **Plastics Analysis Mode** is available from the **Bulk Mode Menu**. This mode alloys you to perform tests on plastics and electronics to determine their content of critical elements. Your analyzer first determines whether the sample is PVC or non-PVC based material. Because PVC's are much denser than non-PVC materials, your analyzer uses a different calibration model to ensure the most accurate results possible.

Select the **Data Entry** icon from the **Plastics Analysis Mode Menu** to prepare to initiate a sample measurement. Type the parameters of the sample directly into the instrument using the **Virtual Keyboard**. The parameters you choose will be attached to the results of the next **Plastics Analysis Mode** test you perform.

Thickness Correction

Plastics, and polymers in general, unlike metals or soil, are very weak absorbers of X rays. This is because polymers are composed mainly of very light elements such as carbon and hydrogen. While just half a millimeter of steel will completely stop 23.1 keV energy X rays of cadmium, for example, it takes at least 10mm of plasticized PVC and as much as 100mm of polyethylene (PE) to do so. Fortunately, polymers that may contain cadmium (Cd), lead (Pb) and other restricted elements would also contain considerable quantity of elements such as antimony (Sb), bromine (Br), titanium (Ti), etc. Their presence results in much stronger absorption of X rays which means that, instead of 100mm, it takes only about 15mm of compounded PE to achieve saturation thickness for these X rays.

If the thickness of analyzed polymer sample is less than 5mm for PVC or less than about 9mm for a "typical" PE, the measured intensity of X rays will be a function of both analyte concentration and sample thickness. This is why measurements performed on thin samples (less than saturation thickness) need to be corrected for thickness.

How to apply Thickness Correction.

In order for the instrument to apply thickness correction to the measured concentration results, the user must be using the Thickness Correction screen and enter the thickness of the analyzed plastic object expressed in [mm] before the measurement is initiated. The thickness may be entered with precision to the second decimal place, although in practice only one decimal place is sufficient for effective correction.

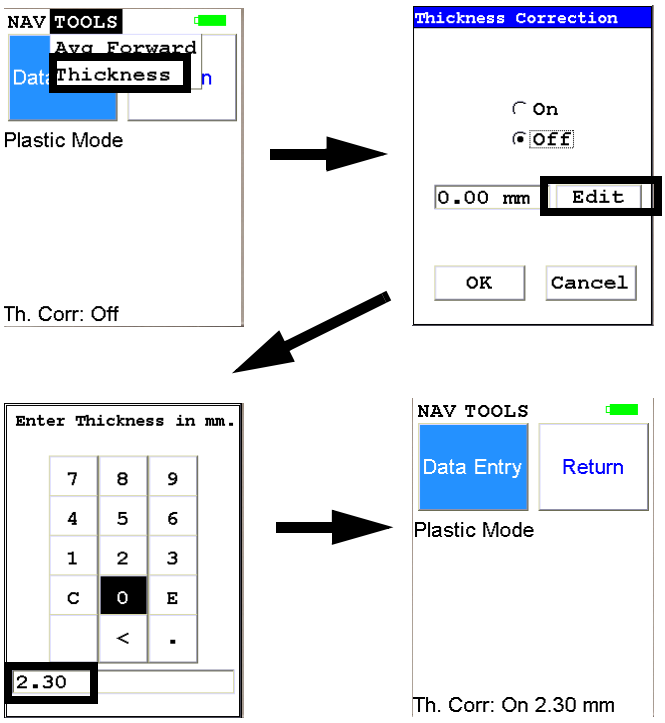


Figure 1-3. How to enable and adjust Thickness Correction for Plastics Analysis

When to use Thickness Correction

Thickness Correction should only be used during the analysis of plastic (polymer) objects. It has been experimentally verified that the correction algorithm will yield satisfactory results, for a 60 second minimum testing time, for samples as thin as 0.3mm. Nevertheless, the recommended range of use of the correction is from 1mm upwards. It is imperative that this correction is not used for thin films such as single foils and plastic membranes; analysis of thin films is performed using the Thin Sample Mode. (Contact Contact Thermo Scientific or your local NITON Analyzers representative for information on this testing mode.)

Whenever possible, one should analyze as thick a sample as available. For example, if the analyzed object is a piece of heatshrink tubing with wall thickness of 0.3mm, the best way to analyze it is to obtain several pieces of the tubing (four for example) and stack them like a flat sandwich, with the thickness correction set to 1.2mm. Doing so makes for faster and more precise analyses. While it would be possible to analyze just a single layer of the tubing with correction at 0.3 mm, by stacking several layers we reduce the relative error of measurement (by a factor approximately equal to the square root of the number of layers). Conversely, when analyzing thinner samples, we need to extend the measurement time fourfold (by the number

of layers) in order to maintain the same relative error of measurement. We can see how quickly measurement time would escalate to impractical levels for thinner samples.

Examples

The most frequent instances in which thickness correction would be called for are analyses of plastic sheeting or plastic insulation on wires and/or cables and heat shrink tubing. Flat plastic sheeting or plastic enclosures pose no problems. We can either analyze an object “as is”, or stack several layers of it before analysis. Plastic insulation such as that on wiring or cables requires a little more sophisticated approach. First, the wire must be removed so that only insulation is analyzed. Then, the insulation should be flattened for analysis, and a thickness correction should be applied that is equal to double the wall thickness. Alternatively, if the insulation is stiff, it should be cut lengthwise into strands which are placed on the indtrument for analysis. The applied thickness correction should be equal to the wall thickness of the sleeve. Both operations are shown in Figure 1-4 and Figure 1-5.

Figure 1-4. Wire insulation cut into strands.

Figure 1-5. PVC wire insulation with conductor removed

A piece of large diameter heat shrink tubing presents an interesting case. It is tempting to analyze this object as is - see Figure 1-6. However, one needs to know that while lead or bromine or chromium X-rays from the upper wall of tubing will not contribute to the signal measured, X rays of such elements as cadmium, antimony, tin or barium in the upper wall will significantly contribute to overall signal. It is therefore imperative to either flatten the tubing for analysis or cut it in pieces and then analyze as shown in Figure 1-7.

Figure 1-6. Incorrect Way to Measure Heat Shrink Tubing

Figure 1-7. Correct Way to Measure Heat Shrink Tubing

WARNING! Thickness correction is only for use with plastic/polymer samples.

Analyzing Bulk Samples

CAUTION Whenever you turn on your NITON Analyzer after it has been off for more than 30 minutes, you should measure your check sample to assure proper operation. If the instrument is not reading properly, you should re-calibrate your NITON Analyzer's sample analysis electronics before you start to take readings. When the instrument is turned on after being off for more than 30 minutes, your NITON analyzer will require a 10 minute warm-up period before the instrument can be calibrated, unless this 10 minute warm-up period is manually overridden.

There are seven different methods of operation for taking a sample measurement, and your analyzer will be configured to use one of those methods for soil samples, depending on the regulatory requirements of your locality. These methods are:

- Trigger-Only method. With the Trigger-Only method, you only need to place the measurement window close to the sample to be analyzed and pull the trigger for sample analysis to be initiated.

- Trigger-and-Proximity-Sensor method. With the Trigger-and-Proximity-Sensor method, you must place the measurement window against the sample to be analyzed to engage the proximity sensor on the front of the instrument, then pull the trigger for sample analysis to be initiated.

- Momentary-Trigger-Touch-and-Proximity-Sensor method. With the Momentary-Trigger-Touch-and-Proximity-Sensor method, you must place the measurement window against the surface to be analyzed to engage the proximity sensor on the front of the instrument, then pull the trigger.

- The trigger may be released and the reading will continue until you release the proximity button, or other criteria (such as Max Time) are reached.

- Trigger-and-Interlock method. With the Trigger-and-Interlock method, you need to place the measurement window close to the sample to be analyzed, press and keep pressing the interlock button at the rear of the instrument with your free hand, then pull the trigger for sample analysis to be initiated.

- Trigger-Interlock-and-Proximity-Sensor method. With the Trigger-Interlock-and-Proximity-Sensor method, you must place the measurement window against the sample to be analyzed to engage the proximity sensor on the front of the instrument, press and keep pressing the interlock button at the rear of the instrument with your free hand, then pull the trigger for sample analysis to be initiated.

- Easy Trigger method. With the Easy trigger method, you need only place the measurement window against the sample area and pull the trigger once to initiate a sample analysis. Your analyzer will continuously sample the backscatter, using a complex internal algorithm, to determine if the measurement window is against a sample or pointing to the empty air. If it finds that there is no sample directly against the measurement window, the analyzer will stop directing radiation through the window as soon as this determination is made.

Note The analyzer is constantly checking the backscatter characteristics to determine if a sample is against the measurement window, whether or not the Easy Trigger method is being used, and will shut off any radiation directed through the window if it determines that there is no sample present.

With any of these methods, analysis will stop if any one of the preconditions are violated. For example, with the Trigger-Interlock-and-Proximity-Sensor method, if the trigger or the Proximity Sensor or the Interlock is released, the reading will stop immediately, and the shutters will close, and the X-ray tube will shut down.

After your NITON analyzer is calibrated, initiate a sample reading using the appropriate method. If you attempt to initiate a sample reading using a different method, the analyzer will inform you that one or more of the preconditions need to be met in order for sample analysis to begin. Initiate the proper preconditions for operation to turn on the x-ray tube, open the calibration shutter, and begin a measurement. Although the three LED lights will begin to flash as soon the initiating preconditions are met, as a safety precaution, the x-ray tube will not turn on immediately, and no reading will begin for approximately 0.5 seconds.

WARNING! Do not attempt to take measurements while downloading readings! This will generate an error requiring a system reset, and may corrupt your stored readings, requiring all stored readings to be erased. ♦

WARNING! When all four LED lights are blinking, the x-ray tube is on. This should only occur during a measurement, while the preconditions for operation are met. On startup, the front pair of lights will blink. If the LED lights blink at any other time, disconnect the battery pack and call Thermo Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, or your local Authorized NITON Analyzer Service Center. ♦

To end the test, simply release the trigger mechanism, or any other applicable preconditions.

Note The four LED lights will blink whenever the x-ray tube is powered on and shutter opened.

Your NITON Analyzer will display the Results Screen throughout the duration of each reading, The Results Screen is updated regularly throughout the reading. When the reading is complete, a final screen update will appear, and your NITON analyzer will display the final results of the measurement which has just been completed.

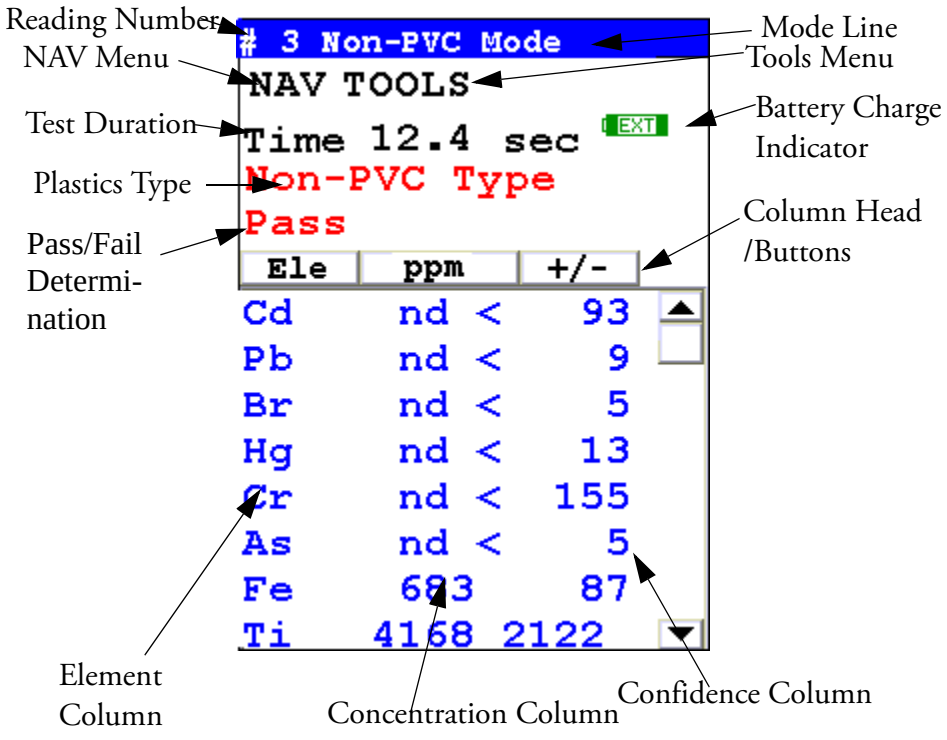


Figure 1-8. The Plastics Mode Result Screen

The Results Screen displays the following information:

- The Reading Number line shows a number automatically assigned by your NITON analyzer in order to uniquely identify each reading. The reading number automatically increments up by one with each successive reading.
- The **Mode** line displays the mode cuurently in operation.
- The **Plastics Type** displays wether the plastic in the sample was found to be PVC or Non-PVC type.
- The Pass/Fail Determination ells at a clance whether the reading is in or out of compliance.
- The **Test Duration** line shows the number of nominal seconds elapsing since the initiation of the reading. Nominal seconds are true, clock seconds when the analyzer is taking a measurement.
- The **Battery Charge Indicator** displays the current charge remaining in the battery.
- The **Mode** line displays the test mode in use during the measurement.
- The **Element** (left) column shows the elements that have been detected in the sample.
- The **Concentration Level** (central) column shows the concentration levels of the corresponding elements in percentages.
- The **Confidence** (right) column displays the 2 sigma (95%) confidence interval for the corresponding elements.

The **NAV Menu** button allows you to access the NAV Menu

The **Tools Menu** button allows you to access the Tools Menu.

Testing Prepared Samples

Set the NITON test platform on a flat, solid surface. Slide out the drawer and place the sample cup mylar side facing up in the holder and slide the drawer shut. Insert the instrument into the nose cone adaptor so that the LCD screen is facing in the same side as the test platform drawer and follow ex-situ bulk sample instructions

The Data Entry Screen

The **Data Entry Screen** is accessed whenever you select the **Data Entry** icon from any screen. This screen allows you to input data in several different fields, or categories, concerning your sample. These fields are saved along with the reading, and allow you to associate important information about the sample directly with the reading, so that you have a full description of the sample tied into the reading itself.

Once you have input data into a field, that information carries over into the next reading, so that you only have to input the information that has changed since the last reading. For example, if you are analyzing several samples of a particular lot, you only need to input the lot information once during that series of readings, changing only the sample name.

Data Entry Screens for Plastics Mode

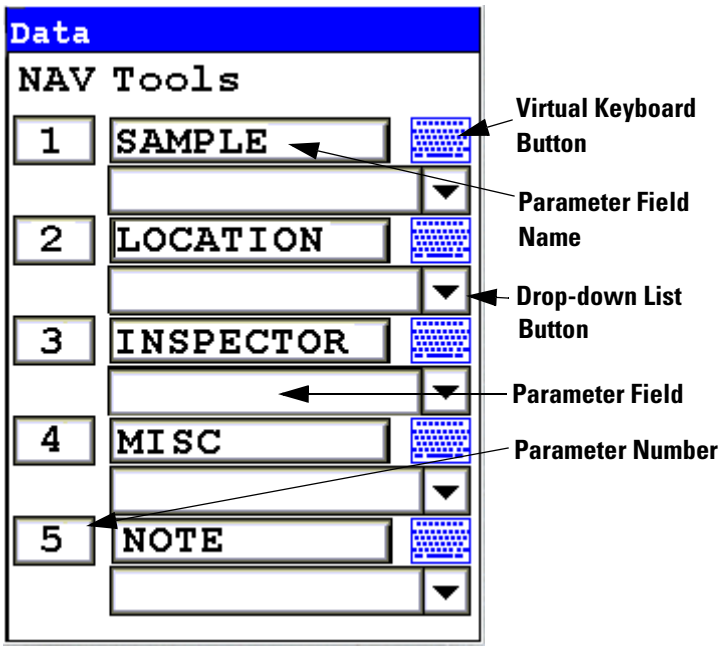


Figure 1-9. Data Entry Screen

This is the only section of the Data Entry Screen. There are five parameters in this section.

Selecting **Sample** allows you to input the sample name parameter

Selecting **Location** allows you to input the particular location information, if known

Selecting **Inspector** allows you to specify the inspector.

Selecting **Misc** allows you to input miscellaneous parameters

Selecting **Note** allows you to input notes on the sample

Navigating the Data Entry Screen

Figure 1-10. The Control Panel

The following description of screen navigation using the control panel assumes that the analyzer is held so that the display is held upright as in Figure 1-10.

- To move from column to column, use the Right and Left portion of the 4-way touch pad.
- To move from row to row, use the Up and Down portions of the 4-way touch pad.
- To select the highlighted option, press the Enter button on the control panel.

The **Data Entry Screen** is divided into sections of 5 setting parameters. By using the Down portion of the 4-way touch pad when you are on the last row of a section, the display will change to the next section. By using the Up portion of the 4-way touch pad when you are on the first row of a section, the display will change to the previous section.

By selecting the **On/Off** button, you can exit the **Data Entry Screen**.

The Virtual Keyboard

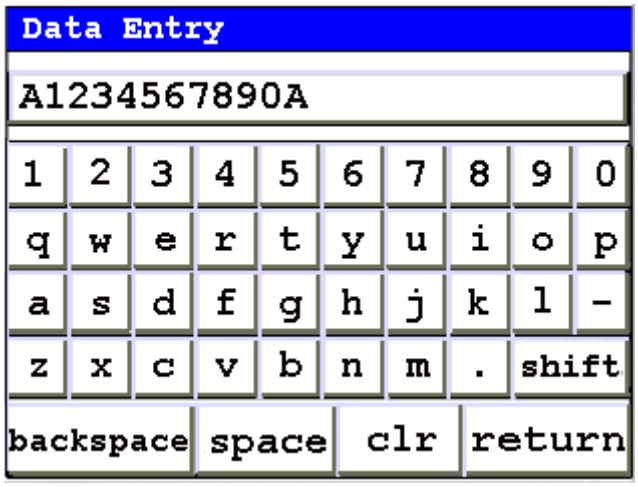


Figure 1-11. Lower Case Virtual Keyboard

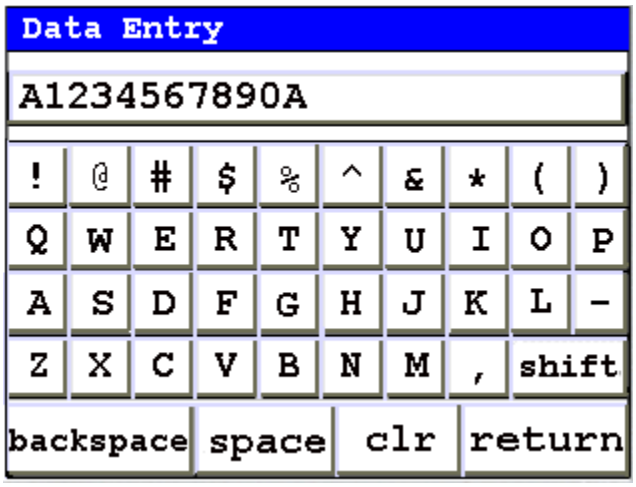


Figure 1-12. Upper Case Virtual Keyboard

The Virtual Keyboard is an alphanumeric keyboard which appears on the LCD Touch Screen Display. You can use the Virtual Keyboard either with the four-way touch pad and control panel buttons, or using the touch screen display directly.

At the top of the screen is the data field you are entering data into, in this case"A1234567890A". Also in this field is the underscore cursor, which graphically shows where the next character will be placed. Up to 25 characters can be stored in the data fields, though only the first 15 will be displayed on the analyzer's touch screen.

Next is the **Virtual Keyboard** itself, with numbers 0-9, letters A-Z, the special characters *,<,>, and -, and the Shift key, to toggle between upper and lower case keyboards.

Last is the control key line. This contains the keys for Return, Space, Clr, and Backspace. The Return key will enter the data and return you to the Data Entry Screen, the Backspace key will delete the last entered character, the Space key will insert a space at the cursor position, and the Clr screen button will clear the data you have entered.

Since the **Virtual Keyboard** is oriented 90 degrees from the standard in order to use a landscape display, the down portion of the 4-way touch-pad will select the key to the right of the current position, the left portion will select the key immediately below, the up portion will select the key to the left, and the right portion will select the key will select the key immediately above, Use the Select and Enter button to enter the currently selected key.

All Alloys Analysis

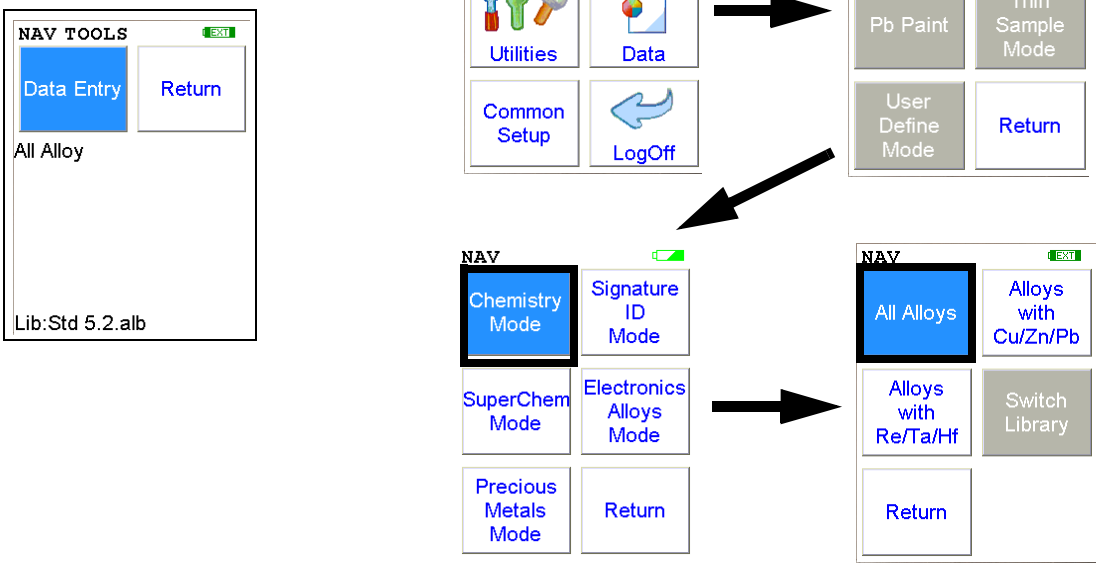


Figure 1-13. All Alloys Menu Path

From the **All Alloys Test Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **All Alloys Test Menu** to go to the "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

In this mode, the analyzer will test the chemistry it detects against the chemistries in the NITON Alloy Library to find the best match.

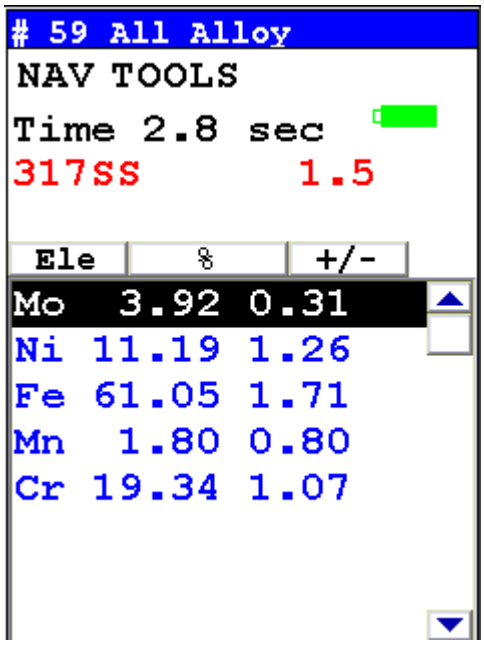


Figure 1-14. All Alloys Reading Screen

In Figure 1-14, the reading is showing a *Match* with 317SS after 2.8 seconds. The Match Number is at 1.5, which is a Good Match at 2.0 or less. Further testing time is not needed.

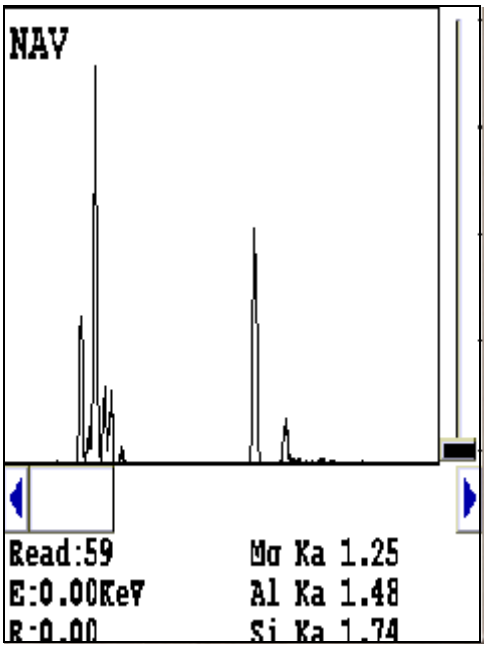


Figure 1-15. SpectraView Spectrum

Figure 1-15 shows a SpectraView screen. This screen, accessible through the NAV menu, shows the spectrum of a reading qualitatively. See Appendix C for details.

Cu/Zn/Pb Analysis

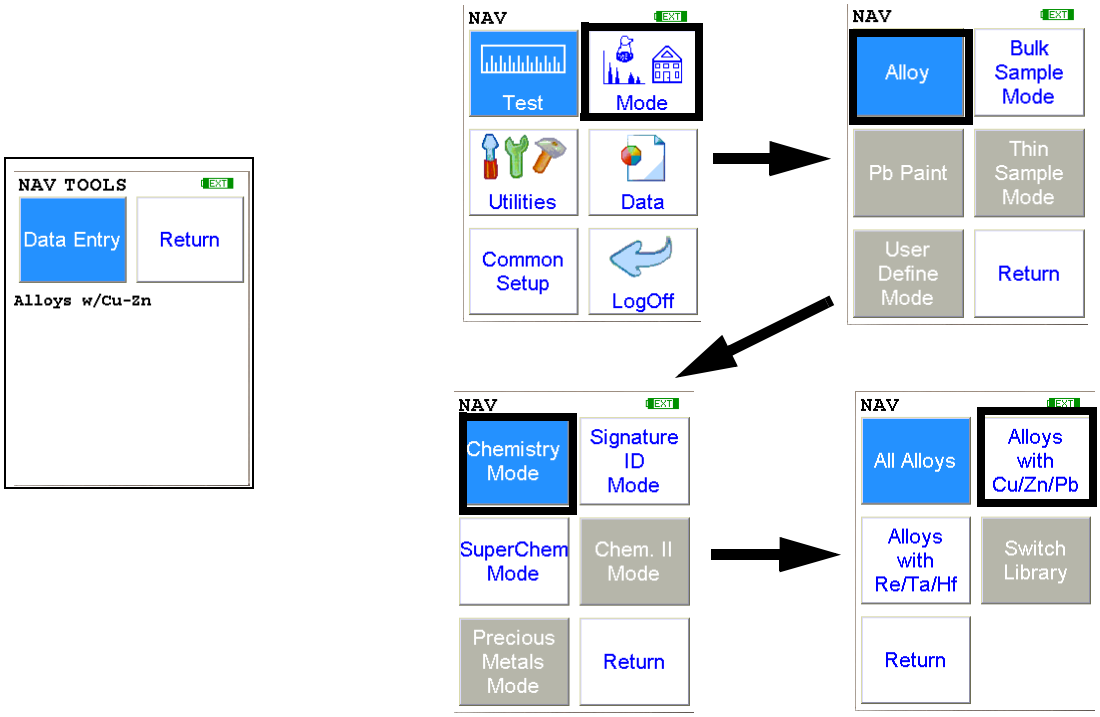


Figure 1-16. Cu/Zn/Pb Menu Path

To access the **Cu/Zn/Pb Test Menu**, select the **Alloys with Cu/Zn/Pb** icon from the **Chemistry Mode Menu**. From the **Cu/Zn/Pb Test Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **Cu/Zn/Pb Test Menu** to go to the "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

In **Cu/Zn/Pb Chemistry Mode**, all other programmed elements are active in addition to Cu/Zn/Pb (e.g. Ti, Cr, Mn, Fe, Co, Ni, Zr, Nb, Mo, W, etc.). **Cu/Zn/Pb Chemistry Mode** is recommended if you know, without a doubt, that your sample alloy contains Cu, Zn, and/or Pb and not Ta, Hf, or Re. When your NITON analyzer is operating in **Cu/Zn/Pb Chemistry Mode** the NITON analyzer will not measure concentrations of Ta, Hf, or Re in a sample. In this mode, the analyzer will test the chemistry it detects against the chemistries in the NITON Alloy Library to find the best match. In all other respects, the **Cu/Zn/Pb Mode** works in the same manner as the **All Alloys Mode**.

Ta/Hf/Re Test Menu

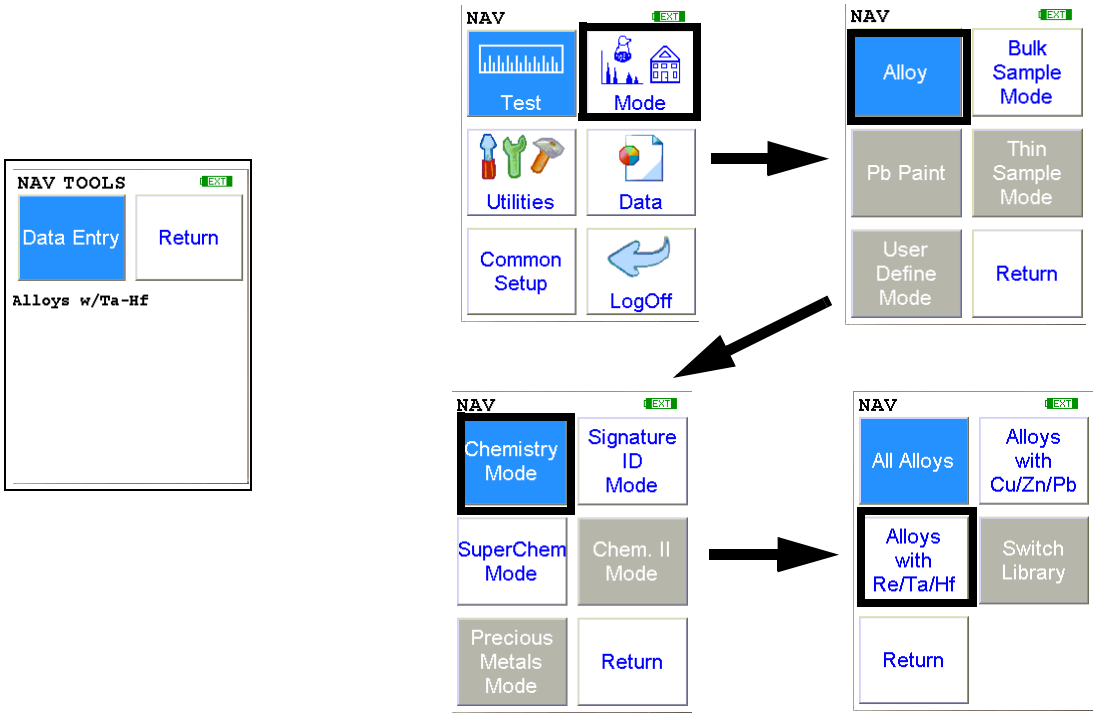


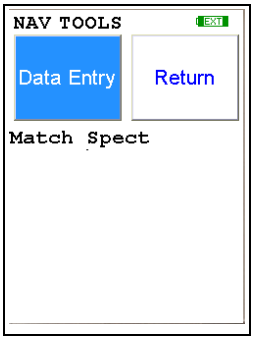
Figure 1-17. Ta/Hf/Re Menu Path

To access the **Ta/Hf/Re Test Menu**, select the **Alloys with Ta/Hf/Re** icon from the **Chemistry Mode Menu**. From the **Ta/Hf/Re Test Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **Ta/Hf/Re Test Menu** to go to the "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

In **Ta/Hf/Re Chemistry Mode**, all other programmed elements are active in addition to Ta/Hf/Re (e.g. Ti, Cr, Mn, Fe, Co, Ni, Zr, Nb, Mo, W, etc.). **Ta/Hf/Re Chemistry Mode** is recommended if you know, without a doubt, that your sample alloy contains Ta, Hf, and/or Re and not Cu, Zn, or Pb. When your NITON analyzer is operating in **Ta/Hf/Re Chemistry Mode** the NITON analyzer will not measure concentrations of Cu, Zn, or Pb in a sample. In this mode, the analyzer will test the chemistry it detects against the chemistries in the NITON Alloy Library to find the best match. In all other respects, the **Ta/Hf/Re Mode** works in the same manner as the **All Alloys Mode**.

Match Signature Analysis



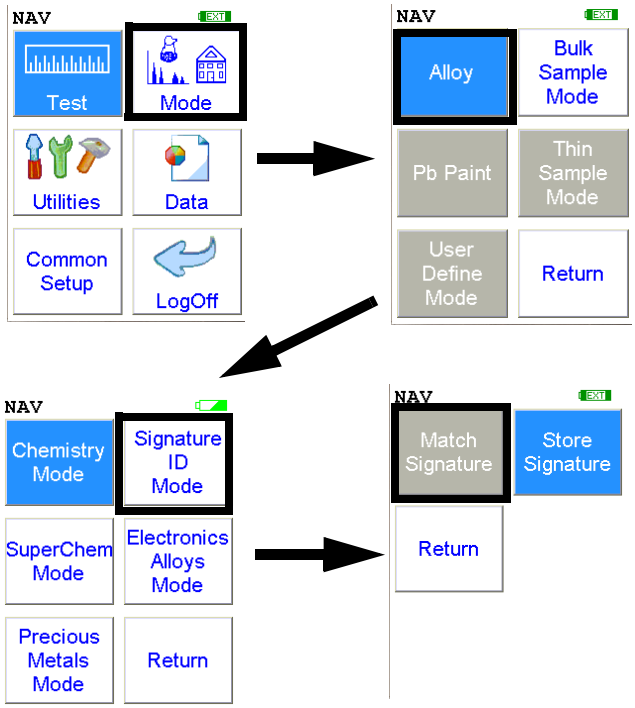


Figure 1-18. Match Signature Menu Path

From the **Match Signature Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **Match Signature Test Menu** to go to the "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

When you take a measurement of the test sample, your analyzer will compare the signature of this unknown sample against signatures of reference samples in Match Signature Mode.

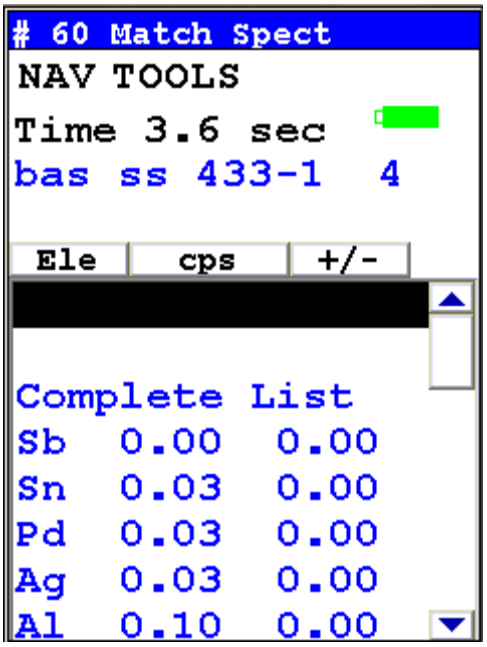


Figure 1-19. Matching a Reference Sample with Match Signature Analysis

The Store Signature Screen

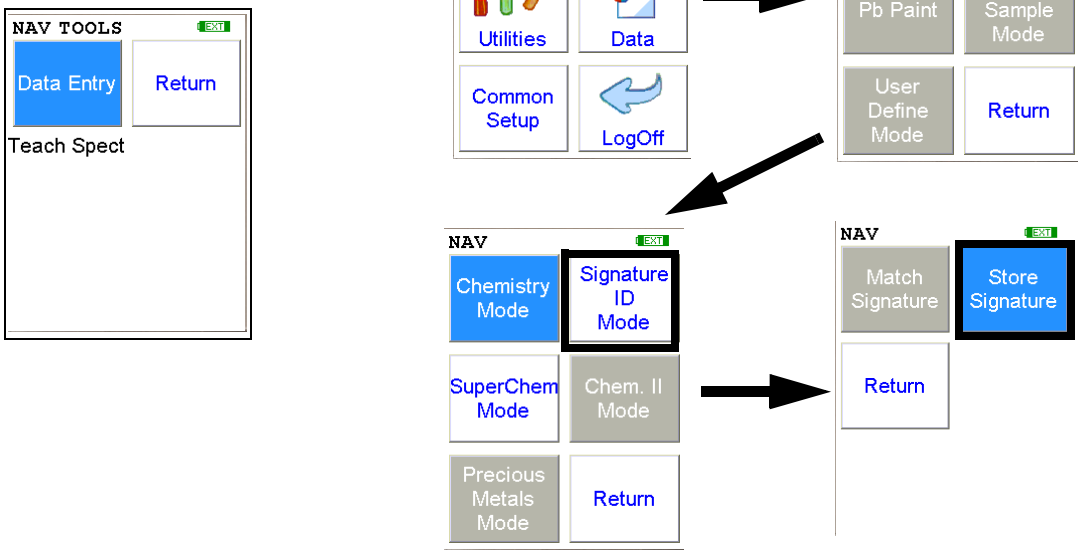


Figure 1-20. The Store Signature Menu Path

From the **Store Signature Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **Store Signature Menu** to go to the "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

After the data entry is complete, take a 60 second minimum measurement of the reference sample you have named. The analyzer will build a signature of this reference sample to compare against unknown samples in **Match Signature Mode**.

CAUTION When teaching your analyzer a new alloy signature in **Match Signature Mode**, the measurement must be taken for at least a full 60 nominal seconds, as displayed on your analyzer's touch screen display. ♦

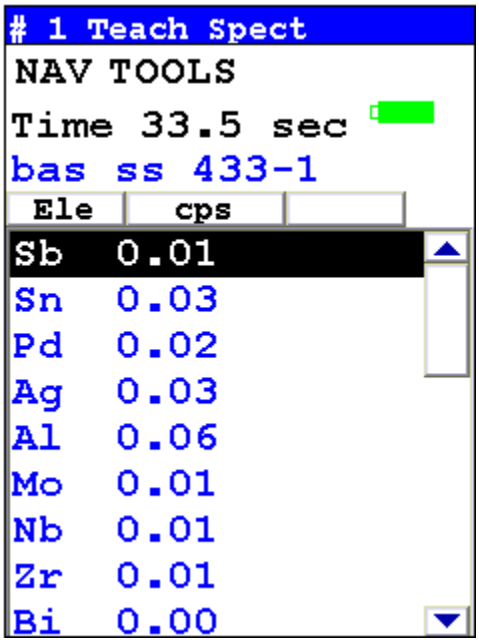


Figure 1-21. Producing a Signature Reading of a Reference Sample

SuperChem Analysis

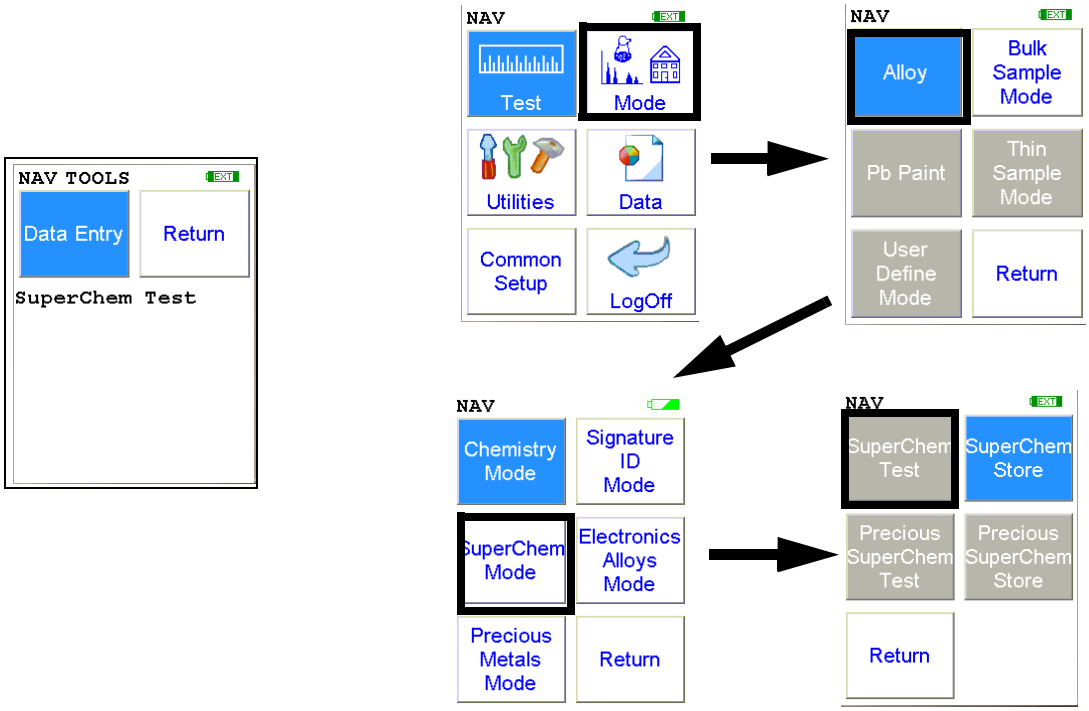


Figure 1-22. The SuperChem Test Menu Path

From the **SuperChem Test Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **SuperChem Test Menu** to go to the "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

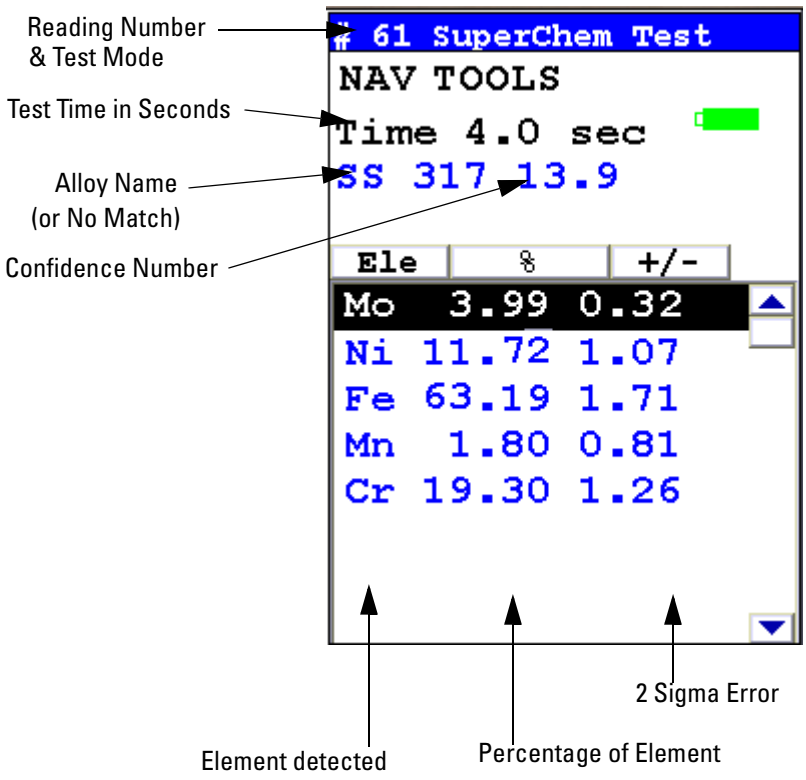


Figure 1-23. SuperChem Test Results Screen

While your analyzer is analyzing the alloy, you will see a screen similar to Figure 1-23. This screen will be displayed on your display until a matching reference sample is found. The 2 Sigma Error means that it is 95% certain that the actual value varies no more than this amount from the reported value. The Alloy Name Confidence Number is a best fit calculation. The closer this number is to zero, the better the match.

The analysis will continue until you stop it, with the analysis getting more refined as time goes on. When you stop the reading, the screen stops updating and stays the same, as in Figure 1-23.

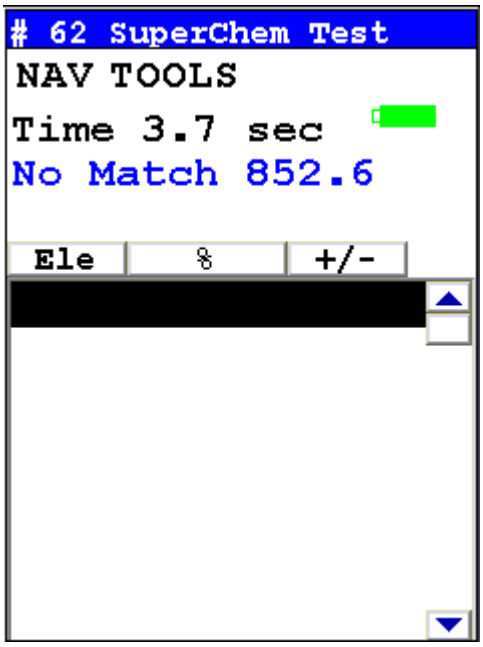
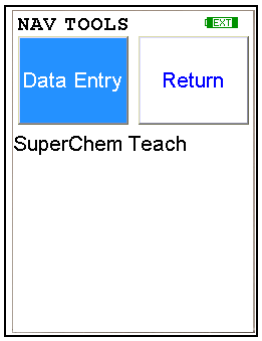


Figure 1-24. No Match Screen

If the XRF Analyzer determines that the sample that you are testing does not match any of the samples that you have specified in your library, it displays "No Match."

The SuperChem Teach Menu



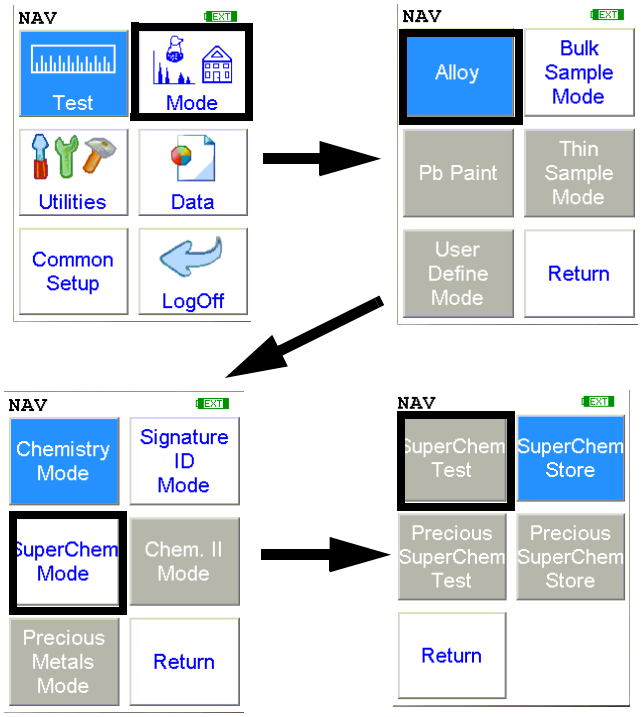


Figure 1-25. The SuperChem Teach Menu Path

From the **Super Chem Teach Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **SuperChem Teach Menu** to go to the "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

After the data entry is complete, take a 60 second measurement of the reference sample you have named. The analyzer will build a signature of this reference sample to compare against unknown samples in SuperChem Mode.

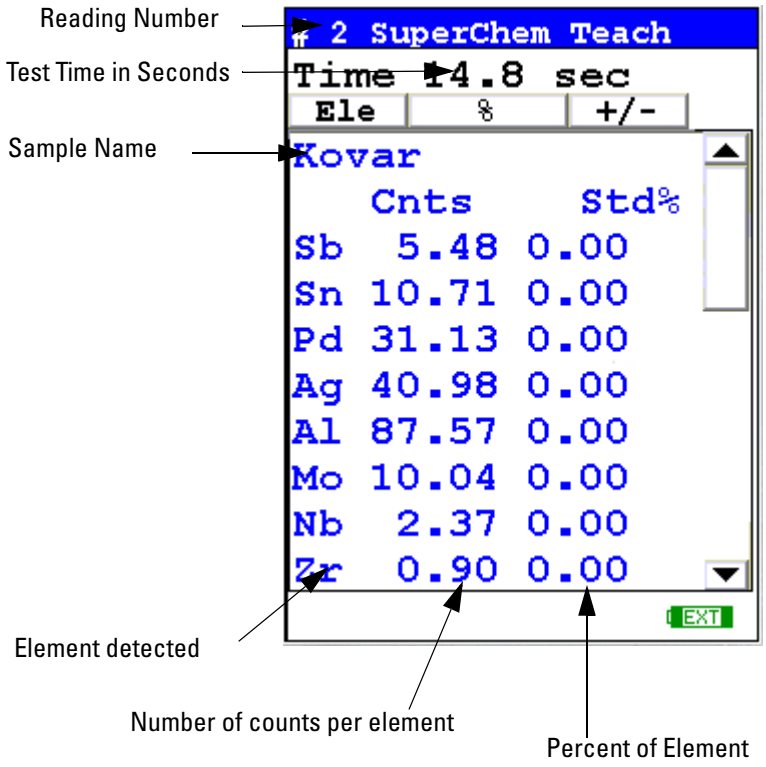


Figure 1-26. The SuperChem Teach Mode Reading Screen

While your analyzer is analyzing the alloy, you will see a screen similar to the screen in Figure 1-26. The screen shows the counts per second for each element, and the default (zero) percentage of each element in this alloy. However, if the name of the sample matches one of the entries in the SuperLib, then that chemistry will be automatically filled in.

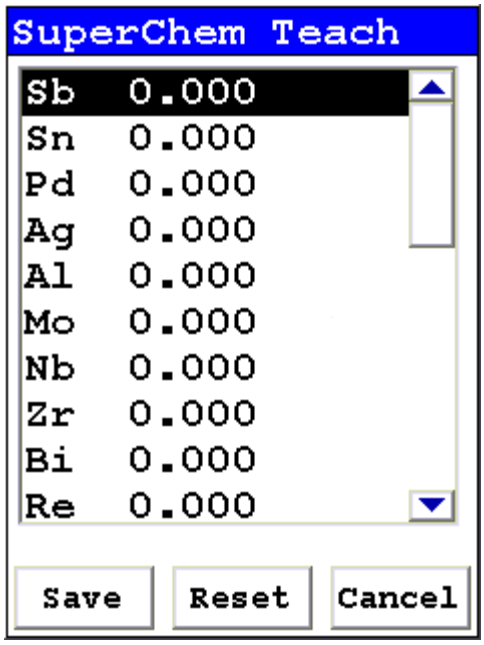


Figure 1-27. SuperChem Teach Composition Screen

When you stop the reading, the screen changes to a new configuration showing the alloy elements in one column and a second column filled with zeros. The zeroes are the default percentages of elements actually contained in the sample. By selecting a blank percentage, you may edit the composition percentages to conform precisely to the certified values of your particular reference.

The **Super Chem Teach Composition Screen** is scrollable, and lists each element used in the analyzer's alloy analysis. Use the 4-way touch pad to move through the listing, and the enter button to select the element you wish to edit. Entering the percentages is done through an interface similar to the one used to log in, as described below and as shown in Figure 1-28.

Note All constituent element percentages for a SuperChem alloy must add up to approximately 100%. If an element is listed as "Balance," that element's concentration must be determined and entered into the SuperChem Teach data entry screen. For all non Helium purged analyzers, if a certification does not equal 100%, then the remaining concentration of unmeasurable elements must be summed and entered as Al. ♦

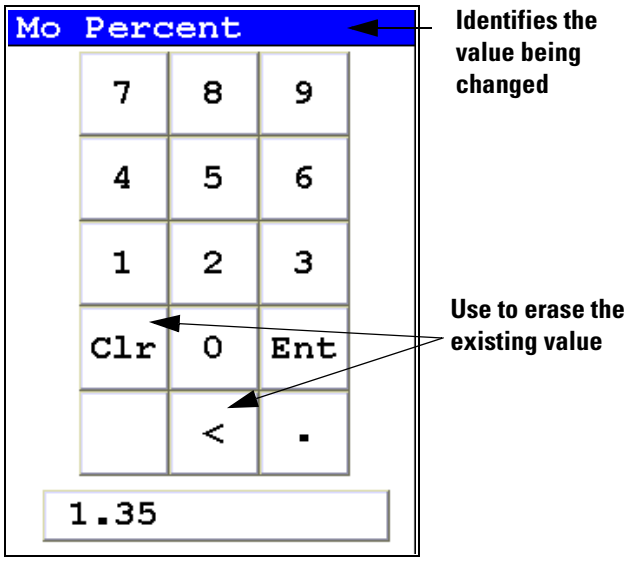


Figure 1-28. SuperChem Teach - Inputting Composition

Again, you can use the 4-way touch pad to navigate and the enter key to select, or use the LCD touch screen. First, always select the “C” button to clear the entire percentage to a blank state. Otherwise the numbers you input will be appended onto the default percentage (zero). Selecting the “<“ button erases the last number entered, and selecting the “E” key enters the percentage into the field associated with the element you are working on. NITON uses 2 significant digits after the decimal point, and anything beyond 2 places is truncated.

Analysis and Sorting of Aluminum Alloys

Note The information in this section pertains to non-Helium purged analyzers (or Helium purged analyzers run without purge) only. ♦

Introduction

The NITON X-ray fluorescence (XRF) alloy analyzers provide outstanding sorting and analysis capability for alloy families such as red metals, low alloy steels, stainless steels, high temperature alloys, nickel alloys, nickel/cobalt alloys, cobalt alloys, titanium alloys, tool steels, tungsten alloys, and other exotic alloys. Because of the robust, standardless, fundamental parameters (FP) calibration technology now available in NITON portable XRF analyzers, these alloy groups are ideally suited for the XRF technology. Calibrations can cover the range from detection limit to 100% concentration with extremely high accuracy. However, aluminum alloys are generally best analyzed by Optical Emission spectrometers.

Comprehensive sorting of aluminum alloys requires analysis of elements too "light" for portable XRF analysis, such as magnesium, silicon, and aluminum, in addition to the other alloying elements that are in the measurement range for portable XRF. Aluminum, silicon, and magnesium are all combined in the 'element' labeled "Al" content, which is computed by subtracting the detected elements from 100%. This limits portable XRF analyzers to sorting of wrought aluminum by series and/or some specific aluminum grades within a particular series. Sorting capabilities include the 1000, 2000, 3000, 6000 and 7000 series. Some 4000 and 5000 alloys can be determined, but only if they have a unique alloying content based on elements other than Si or Mg (different from any other aluminum grade in the same or any other series). Separating cast aluminum alloys that differ only in Si content is not possible with XRF.

Performance

Reliable separation of common alloy grades such as 1100, 2024, 3003, 6061, 6063, 7050, and 7075 from each other is possible since these alloys do not depend on "light elements" for discrimination. Instead, the elements Mn, Fe, Cu, Zn and Zr constitute the differentiating alloying elements in the above examples. Since many 5000 series wrought aluminum alloys are different only in Mg, and many 4000 wrought aluminum alloy series are different only in Si, grade determination within these groups is only sometimes, but not always, possible. The NITON analyzer chemistry is quite reliable and accurate for the elements listed below under "sorting requirements". The attached results are typical of what can be expected.

Sorting requirements

The NITON analyzer will sort those specific aluminum alloys which differ by a few tenths of a percent or more of the detectable alloying elements. Detectable alloying elements found in aluminum alloys include Ti, V, Cr,

Mn, Fe, Ni, Cu, Zn, Zr, Pb, Bi, Ag, and Sn. The light elements Mg, Si or Al are not detectable using portable XRF, without use of a helium purge system.

Specific needs

Please contact your local NITON Analyzer representative for further information, or to discuss your specific aluminum alloy sorting needs. Based on the grades you expect to encounter, Thermo can advise you on the feasibility of meeting your sorting requirements.

Typical Measurement Results Table: (Tube Source)

Standard	ID NITON	Al Act*	Al NITON	Al Err	Zr Act	Zr NITON	Zr Err	Zn Act	Zn NITON	Zn Err
1100-101A	1100	99.22	99.24	0.17	0.01	0.01	0.01	0.03	0.02	0.01
6061-109B	6061	98.89	98.98	0.2	0.003	0	0.01	0.044	0.04	0.01
7050-231AC	7050	90.45	90.8	0.65	0.13	0.12	0.02	6.3	6.29	0.39
2024-104A	2024	94.03	94.46	0.38	0.01	0.01	0.01	0.017	0.04	0.02
7075-111AD	7075	91.33	91.79	0.57	0.032	0.03	0.01	5.87	5.82	0.35
6063-225A	6063	99.41	99.5	0.16	0.004	0	0.01	0.03	0.03	0.01
3003-105AH	3003	97.96	98.1	0.22	0.003	0	0.01	0.02	0.02	0.01

Table continued:

Standard	Cu Act	Cu NITON	Cu Err	Fe Act	Fe NITON	Fe Err	Mn Act	Mn NITON	Mn Err	Cr Act	Cr NITON	Cr Err
1100-101A	0.09	0.08	0.02	0.6	0.48	0.06	0.03	0.02	0.03	0.02	0.03	0.05
6061-109B	0.32	0.28	0.03	0.26	0.23	0.05	0.08	0.1	0.04	0.21	0.15	0.07
7050-231AC	2.36	2.42	0.15	0.13	0.12	0.05	0.08	0.09	0.06	0.026	0	0.08
2024-104A	4.66	4.35	0.24	0.25	0.25	0.05	0.65	0.72	0.09	0.016	0	0.06
7075-111AD	1.69	1.73	0.11	0.28	0.26	0.05	0.048	0.04	0.05	0.21	0.17	0.09
6063-225A	0.08	0.07	0.01	0.21	0.17	0.04	0.083	0.09	0.04	0.024	0.03	0.05
3003-105AH	0.088	0.08	0.02	0.61	0.53	0.06	1.08	1.1	0.1	0.02	0.03	0.06

* Includes all Light Element Content (e.g., Al and Si and/or Mg)

Disabling Aluminum Analysis

In either Alloy Mode or Electronics Alloy Mode, you can disable the analysis of aluminum if you prefer. To disable aluminum analysis, while showing the Ready to Test screen or the Reading Display screen, select the Tools Menu, then select Disable Al from the menu, as in Figure 1-29.

Once disabled, aluminum will not be analyzed, and when downloaded to NDT, a "No Al" flag will be set for that reading. Aluminum analysis cannot be disabled for helium -purged instruments using the Light Filter, as aluminum is required for that setting to function properly.

Figure 1-29. Disabling Al Analysis from the Tools Menu

Analyzing Metal Alloy Samples

CAUTION After being powered on, your NITONnalyzer will perform an internal re-calibration before an analysis is initiated. It is recommended that you let your analyzer warm up for ten minutes after start up, before testing is begun. ♦

There are six different methods of operation for taking a sample measurement, and your analyzer will be configured to use one of those methods for alloy samples, depending on the regulatory requirements of your locality. These methods are:

- Trigger-Only method. With the Trigger-Only method, you only need to place the measurement window flush with the sample to be analyzed and pull the trigger for sample analysis to be initiated.

- Trigger-and-Proximity-Sensor method. With the Trigger-and-Proximity-Sensor method, you must place the measurement window against the sample to be analyzed to engage the proximity sensor on the front of the analyzer, then pull the trigger for sample analysis to be initiated.

- Momentary-Trigger-Touch-and-Proximity-Sensor method. With the Momentary-Trigger-Touch-and-Proximity-Sensor method, you must place the measurement window against the surface to be analyzed to engage the proximity sensor on the front of the analyzer, then pull the trigger. The trigger may be released and the reading will continue until you release the proximity button, or other criteria (such as Max Time) are reached.

- Trigger-and-Interlock method. With the Trigger-and-Interlock method, you need to place the measurement window close to the sample to be analyzed, press and keep pressing the interlock button at the rear of the analyzer with your free hand, then pull the trigger for sample analysis to be initiated.

- Trigger-Interlock-and-Proximity-Sensor method. With the Trigger-Interlock-and-Proximity-Sensor method, you must place the measurement window against the sample to be analyzed to engage the proximity sensor on the front of the analyzer, press and keep pressing the interlock button at the rear of the analyzer with your free hand, then pull the trigger for sample analysis to be initiated.

- Easy Trigger method. With the Easy trigger method, you need only place the measurement window against the sample area and pull the trigger once to initiate a sample analysis. Your analyzer will continuously sample the backscatter, using a complex internal algorithm, to determine if the measurement window is against a sample or pointing to the empty air. If it finds that there is no sample directly against the measurement window, the analyzer will stop directing radiation through the window as soon as this determination is made.

Note The analyzer is constantly checking the backscatter characteristics to determine if a sample is against the measurement window, whether or not the Easy Trigger method is being used, and will shut off any radiation directed through the window if it determines that there is no sample present.

With any of these methods, analysis will stop if any one of the preconditions are violated. For example, with the Trigger-Interlock-and-Proximity-Sensor method, if the trigger or the Proximity Sensor or the Interlock is released, the reading will stop immediately, and the X-ray tube will shut down.

After your analyzer is calibrated, initiate a sample reading using the appropriate method. If you attempt to initiate a sample reading using a different method, the analyzer will inform you that one or more of the preconditions need to be met in order for sample analysis to begin.

Note The four LED lights will blink whenever the x-ray tube is on. ♦

WARNING! The preconditions for operation must be continued for the duration of the reading. If the preconditions are violated, the x-ray tube will turn off, the calibration shutter will close, and the measurement will end. The four LED lights will stop blinking when the measurement is ended. The flashing of the LED lights is not synchronized to minimize power consumption. ♦

To end the test, simply release the trigger mechanism, or any other applicable preconditions.

WARNING! When all four LED lights are blinking, the x-ray tube is on. This should only occur during a measurement, while the preconditions for operation are met. On startup, the front pair of lights will blink. If the LED lights blink at any other time, disconnect the battery pack and call Thermo Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, or your local Authorized NITON Analyzer Service Center. ♦

Note The preconditions for operation may be limited or dictated by the country of operation, and thus some preconditions may not be available as customer options. ♦

The Data Entry Screen

The **Data Entry Screen** is accessed whenever you select the **Data Entry** icon from any screen. This screen allows you to input data in several different fields, or categories, concerning your sample, in several different ways:

- By selecting the Virtual Keyboard button and typing the parameter in using the **Virtual Keyboard**.
- By creating a new, or editing your analyzer's existing, '.ndf' file through the NDT program. You can then select from the various custom options you have created using the Drop-down List button.

These fields are saved along with the subsequent reading, and allow you to associate important information about the sample directly with the reading, so that you have a full description of the sample tied into the reading itself.

Once you have input data into a field, that information carries over into the next reading, so that you only have to input the information that has changed since the last reading. For example, if you are analyzing several samples of a particular lot, you only need to input the lot information once during that series of readings, changing only the sample name.

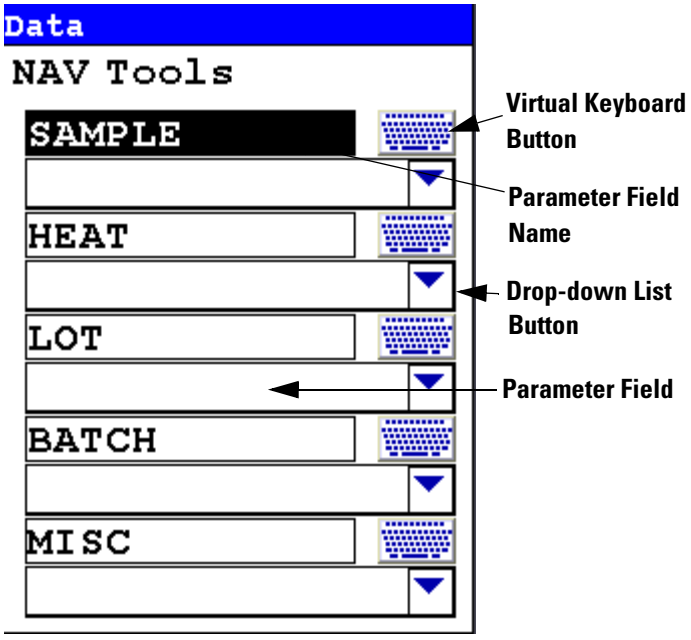


Figure 1-30. The Data Entry Screen - First page

This is the first section of the **Data Entry Screen**. There are five parameters in this section.

Selecting **Sample** allows you to input the sample name parameter

Selecting **Heat** allows you to input the particular heat information, if known

Selecting **Lot** allows you to input the Lot parameter.

Selecting **Batch** allows you to input information on the alloy's Batch number

Selecting **Misc** allows you to input miscellaneous parameters

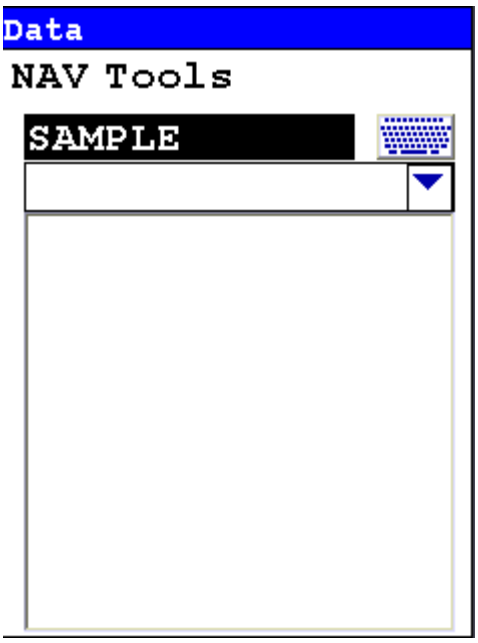


Figure 1-31. The Data Entry Screen - Second Page

This is the second section of the **Data Entry Screen**. There is one parameter in this section.

Selecting **Note** allows you to input notes on the sample

You may enter up to 25 characters in the data entry fields. These 25 characters are saved, and are all visible in NDT, but only the first 15 characters are visible in the field on your analyzer.

Selecting Data Entry from View Data Mode

You can select Data Entry from the NAV Menu while in View Data Mode, but the ability to edit or enter data is disabled. The screen will show the data already entered, with no buttons for drop down menu selection or Virtual Keyboard.

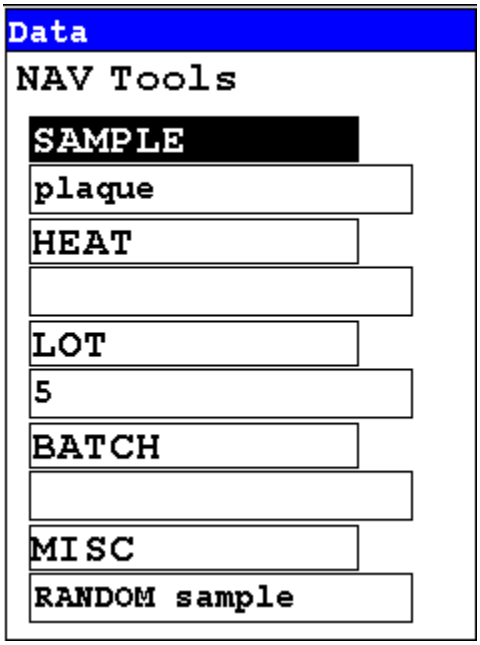


Figure 1-32. Data Entry Screen while Viewing Data

Navigating the Data Entry Screen

Figure 1-33. The Control Panel

The following description of screen navigation using the control panel assumes that the analyzer is held so that the display is held upright as in Figure 1-33.

- To move from column to column, use the Right and Left portion of the 4-way touch pad.
- To move from row to row, use the Up and Down portions of the 4-way touch pad.
- To select the highlighted option, press the Enter button on the control panel.

The **Data Entry Screen** is divided into sections of 5 setting parameters. By using the Down portion of the 4-way touch pad when you are on the last row of a section, the display will change to the next section. By using the Up portion of the 4-way touch pad when you are on the first row of a section, the display will change to the previous section.

By selecting the **On/Off** button, you can exit the **Data Entry Screen**.

The Virtual Keyboard

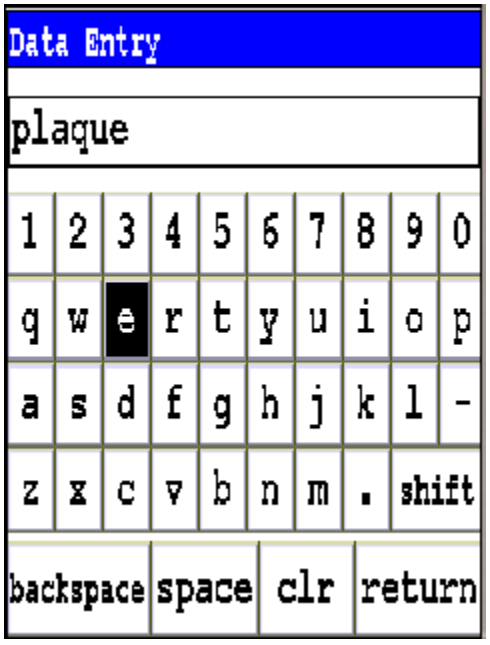


Figure 1-34. Lower Case Virtual Keyboard

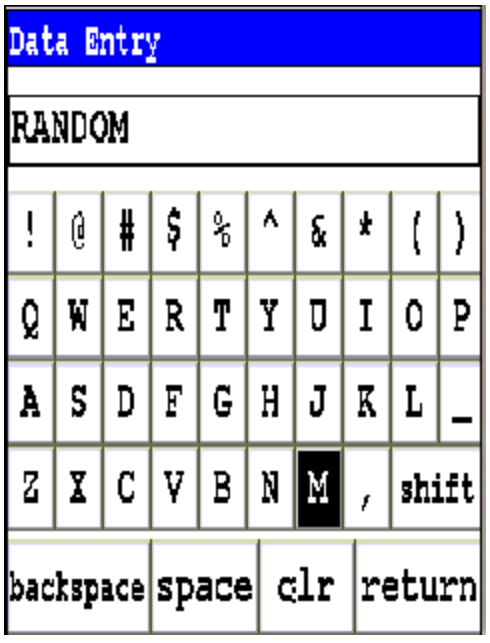


Figure 1-35. Upper Case Virtual Keyboard

The Virtual Keyboard is an alphanumeric keyboard which appears on the LCD Touch Screen Display. You can use the Virtual Keyboard either with the four-way touch pad and control panel buttons, or using the touch screen display directly.

At the top of the screen is the data field you are entering data into, in this case"A1234567890A". Also in this field is the underscore cursor, which graphically shows where the next character will be placed. Up to 25 characters can be stored in the data fields, though only the first 15 will be displayed on the analyzer's touch screen.

Next is the Virtual Keyboard itself, with numbers 0-9, letters A-Z, the special characters *,<,>, and -, and the Shift key, to toggle between upper and lower case keyboards.

Last is the control key line. This contains the keys for Return, Space, Clr, and Backspace. The Return key will enter the data and return you to the Data Entry Screen, the Backspace key will delete the last entered character, the Space key will insert a space at the cursor position, and the Clr screen button will clear the data you have entered.

Since the **Virtual Keyboard** is oriented 90 degrees from the standard in order to use a landscape display, the down portion of the 4-way touch-pad will select the key to the right of the current position, the left portion will select the key immediately below, the up portion will select the key to the left, and the right portion will select the key will select the key immediately above, Use the Select and Enter button to enter the currently selected key.

All screen areas can be directly accessed using the LCD Touch Screen by touch.

The Results Screen

Your NITON Analyzer will display the **Results Screen** throughout the duration of each reading, The **Results Screen** is updated regularly throughout the reading. When the reading is complete, a final screen update will appear, and your NITON analyzer will display the final results of the measurement which has just been completed.

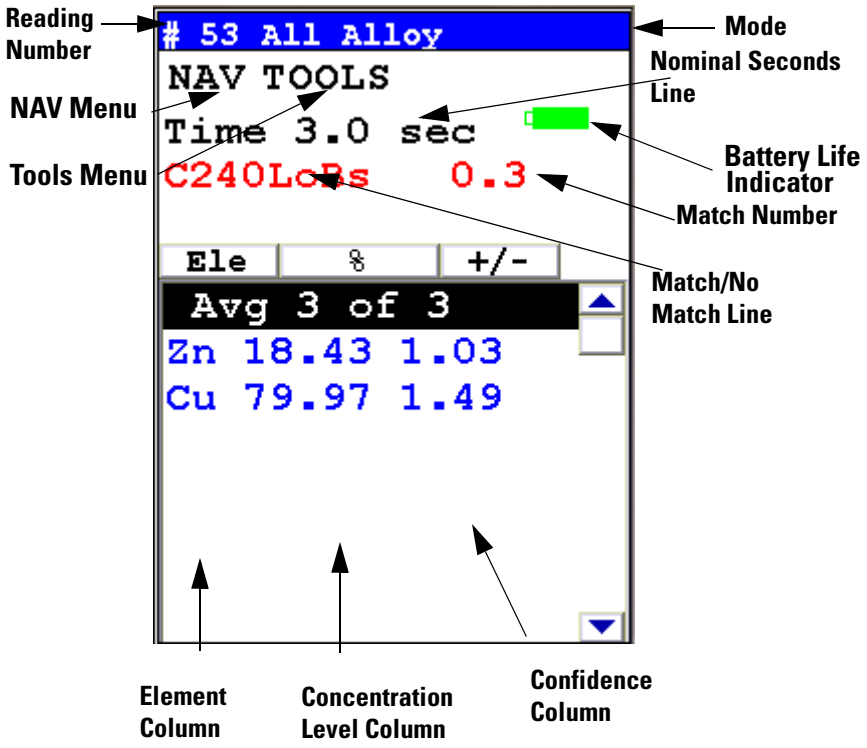


Figure 1-36. The Results Screen

The **Results Screen** displays the following information:

- The **Reading Number** shows a number sequentially assigned by your NITON analyzer in order to uniquely identify each reading. The reading number automatically increments with each successive reading.

- The **Nominal Seconds Test Duration** line shows the number of nominal (source) seconds elapsing since the initiation of the reading. Nominal seconds are instrument time designed to compensate for the electronic dead-time that may occur when your analyzer is taking a measurement, and therefore tend to be a bit slower than real time.

- The **Mode** displays the test mode in use during the measurement.

- The **Match/No Match** line indicates whether your NITON analyzer has found a matching alloy in it's library for the sample you have measured, and displays the name(s) of any matching alloys and the Match Number (chi squared deviation).

- The **Element** (left) column shows the elements that have been detected in the sample.

- The **Concentration Level** (central) column shows the concentration levels of the corresponding elements in percentages.

- The **Confidence** (right) column displays the 2 sigma (95%) confidence interval for the corresponding elements.

If there are too many elements detected to fit onto a single screen, you can see the balance of the elements and their results (as in figure 3-16) by pressing the down arrow of the 4-way touch pad. To see previous results, use the left arrow of the 4-way touch pad. To go forward to later readings, use the right arrow of the 4-way touch pad.

Match Number

The Match Number is a rating of confidence in the identification of the alloy. The Match number ranges from 0.0 to 10.0, with 0.0 being a perfect match. Any number greater than 4.0 gives a result of No Match by default, although you can change this match threshold. Any number less than 2.0 is considered a Good Match, and can usually be brought closer to 0.0 with longer testing times. Numbers between 2.0 and 3.0 can be considered Probable Matches, and numbers between 3.0 and 4.0 as Possible Matches, often having one or more elements out of spec.

Camera and Small Spot Video

The Camera feature is only usable with properly configured analyzers, and the Small Spot feature is only available on Small Spot analyzers.

If your analyzer is equipped with an internal video camera, you can turn that camera on and off, and turn the saving of images with the readings on and off through an interface. When the camera is on, the image will show in the Ready to Test screen, as in Figure 1-4. If the camera is off, saving of images will also be off. If the camera is on and the image saving function is also on, the images will automatically be saved with the reading. Saving images will curtail the maximum number of readings stored.

How to Use the Camera

When a Camera equipped XL3 analyzer is in the Ready to Test screen, the video feed appears live on the analyzer's touch screen. This is the image that can be saved with the sample analysis. When you take a measurement, if you choose to do so, the bitmap image will be saved on the analyzer along with the analysis results. The interface is accessible through the Instrument Setup/Hardware Setup menu, as in Figure 1-2.

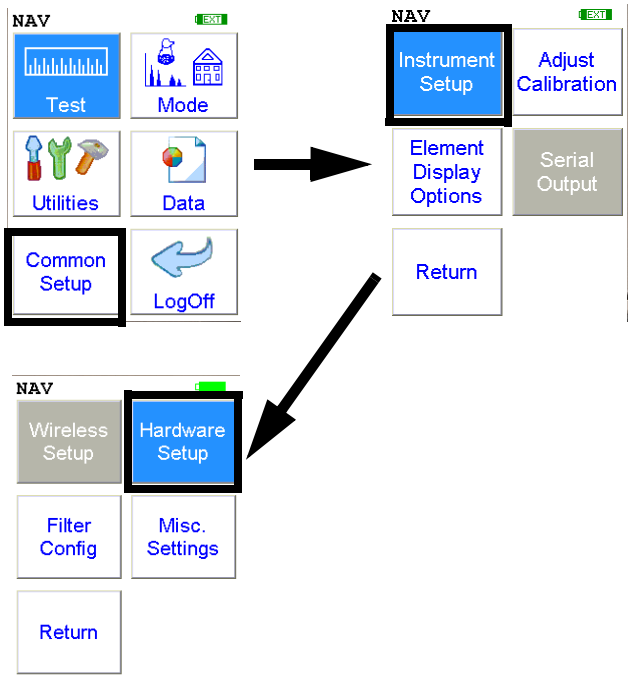


Figure 1-1. The Hardware Setup Menu Path

Figure 1-2. Setting Up the Camera View and Image Saving

Stored camera images from previous measurements can be viewed on the analyzer.

How to Use the Small Spot Technology

With a properly equipped Small Spot analyzer, you can restrict the analysis to a small spot within the camera view. You can toggle the Spot on and off from the Tools Menu as in Figure 1-3.

A red circle with a small hash mark (#) will appear on the display. The small hash marks the center of the x-ray analysis spot, while the larger circle marks the area analyzed.

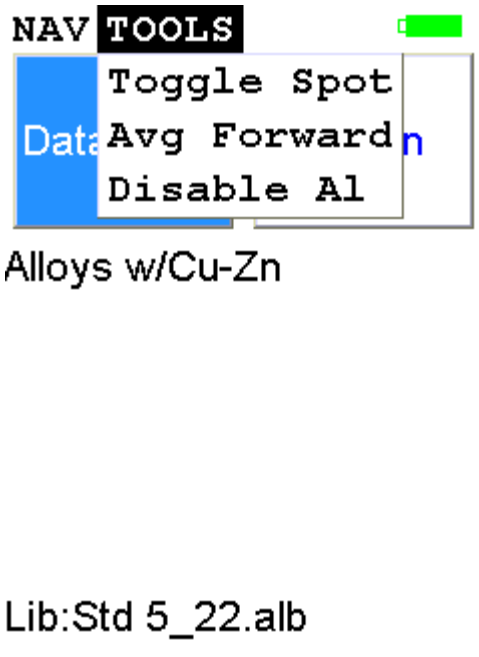


Figure 1-3. Toggling the Small Spot from the TOOLS Menu

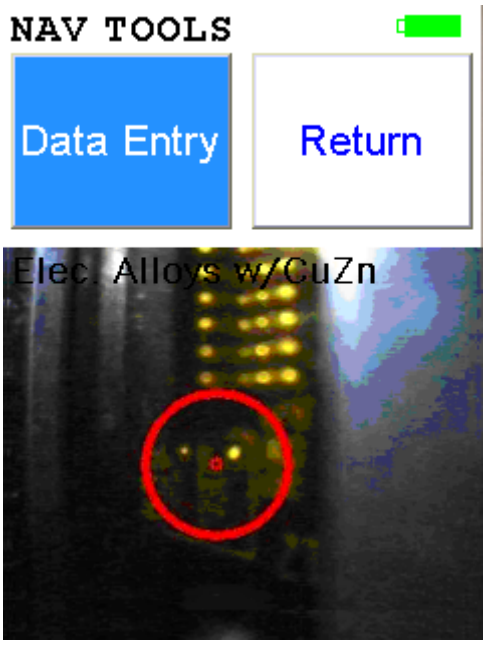


Figure 1-4. Camera View

Using the Small Spot

The Small Spot can be used in several different modes.

Mining

3mm spot size allows analysis of veins and inclusions in mineral samples

Initiate from Tools - Small Spot

He Purged

Helium purge allows analysis of light elements (Mg, V and Ti)

Small spot enables analysis of light elements in welds and inclusions

Helium and Small Spot modes can be used simultaneously for Alloy and Mining modes

Consumer Goods Analysis

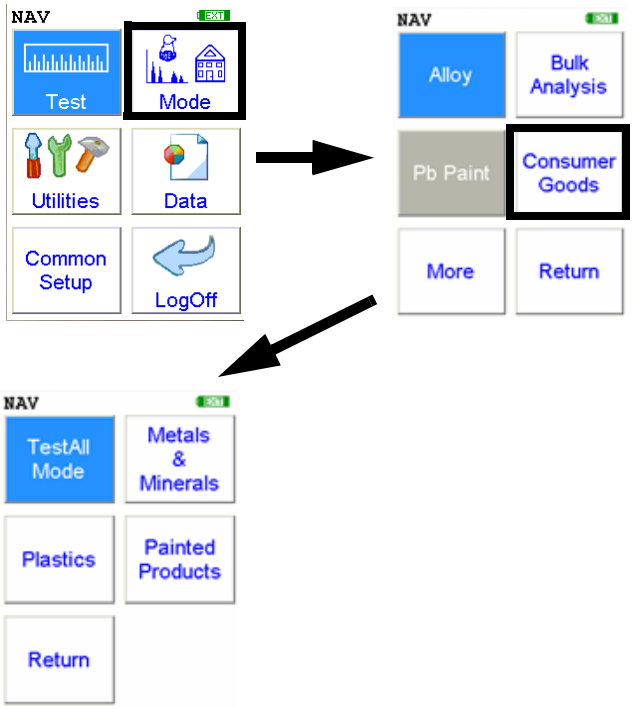


Figure 1-5. Consumer Goods Menu Path

From the **Consummer Goods Analysis Menu**, you can initiate analysis in **TestAll Mode**, **Metals & Minerals Mode**, **Plastics Mode,** or **Painted Products Mode**.

This menu enables you to choose betwen these several different modes for use in testing consumer products. Consumer Goods tests return a result of Pass, Fail, or Inconclusive relative to the criteria set in **Toy Mode Settings**.

TestAll Analysis

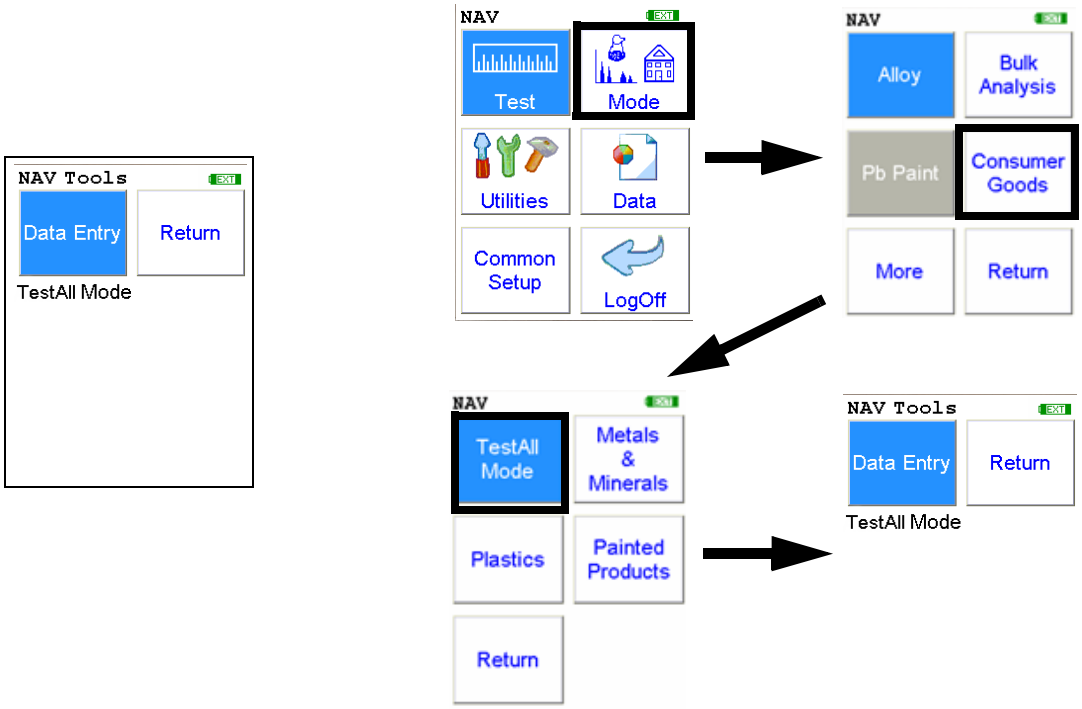


Figure 1-6. TestAll Menu Path

To access the **TestAll Test Menu**, select the **TestAll Mode** icon from the **Consumer Goods Analysis Menu**. From the **TestAll Test Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **TestAll Test Menu** to go to "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

Use **TestAll Mode** when you are uncertain whether one of the more specific Consumer Goods modes would be more appropriate. TestAll Mode analyzes the matrix and selects the classification most appropriate to the test, then applies the appropriate calibration to the data.

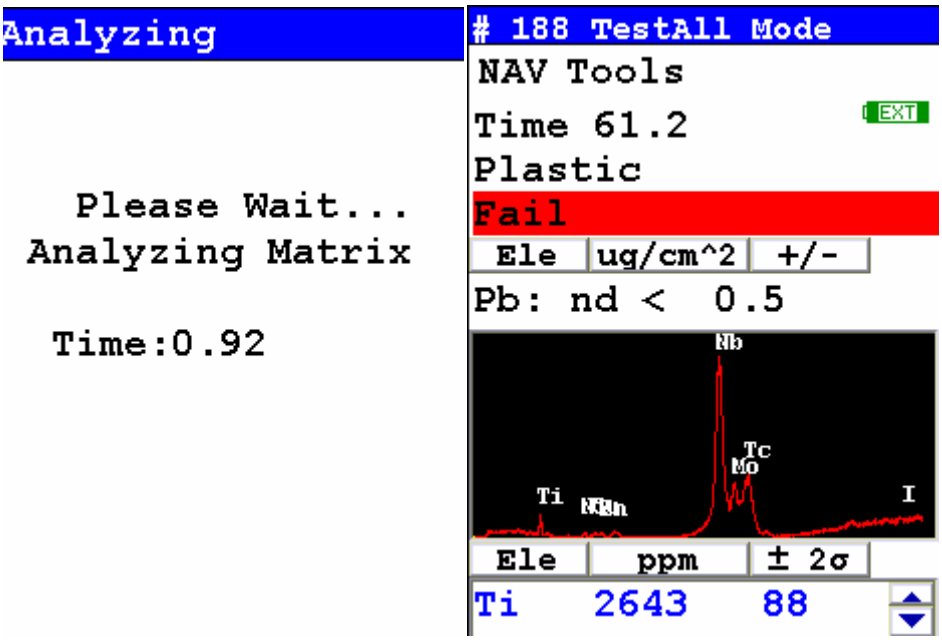


Figure 1-7. Matrix Analysis Screen And Plastic Result Screen

Table 1-1. Test All Categories

Category	Description of Category
Metal	Bulk, unpainted metals and metallic alloys
Painted Metal	Painted metal surfaces
Thin Metal	Foils and very thin metallic samples
Plastic	Non-PVC plastics, unpainted wood, cardboard, and fibres
PVC Plastic	PVC plastics, and any material with a lot of chlorine
Thin Plastic	Thin non-PVC plastics
Aluminum Alloys	Aluminum based alloys
Layered Materials	Layered non-metals, coated items, glazed ceramics
Non-Metal	Soils, minerals, unglazed ceramics, oxides, concrete, sheetrock, sometimes pure aluminum
Other	Similar to Non-Metal, but includes anything which fails the algorithm for Non-Metal.

Metal Bulk, unpainted metals and metallic alloys will be classified as Metal. If the system ID's the sample as a metal it will display the alloy grade match as well, but not the match number.

Painted Metal This is for painted metal surfaces. This is specifically suitable for painted metal toys, die cast objects, and other painted metal surfaces.

Thin Metal This is for thin metal materials.

Plastic This is for non-PVC plastic and samples exhibiting high intensity of Compton scatter. Wood will is also fall in this category as its chemical makeup is very similar to non-PVC polymers and it generates spectra very similar to those of polymers.

PVC Plastic This is for all PVC Type plastics, regardless of thickness of sample. Note, since PVC determination is based on Cl content, any material with high Cl signal will force the PVC Plastic determination.

Thin Plastic Thin polymer (non-PVC type) samples fall in this class.

Aluminum Alloys Obviously, aluminum alloys belong to this class. However, pure Al generates spectral signal so similar to Non-Metal type, that it will often be identified as such.

Layered Materials This class includes samples of layered nonmetals, but not necessarily painted. In this case the outer layer is thick enough to modify spectrum in such a way that we can identify two layers of different materials sandwiched together. A typical examples include glazed ceramics.

Non-Metals This class encompasses bulk, non-metallic and non-plastic materials, such as oxides. This is a large group which includes variety of materials such as soil, ceramics, concrete, and sheetrock.

Other Similar to non-metal class but for some unexpected reason (such as non-typical element) the algorithm cannot classify the measured material into any of the other types.

Metals & Minerals Analysis

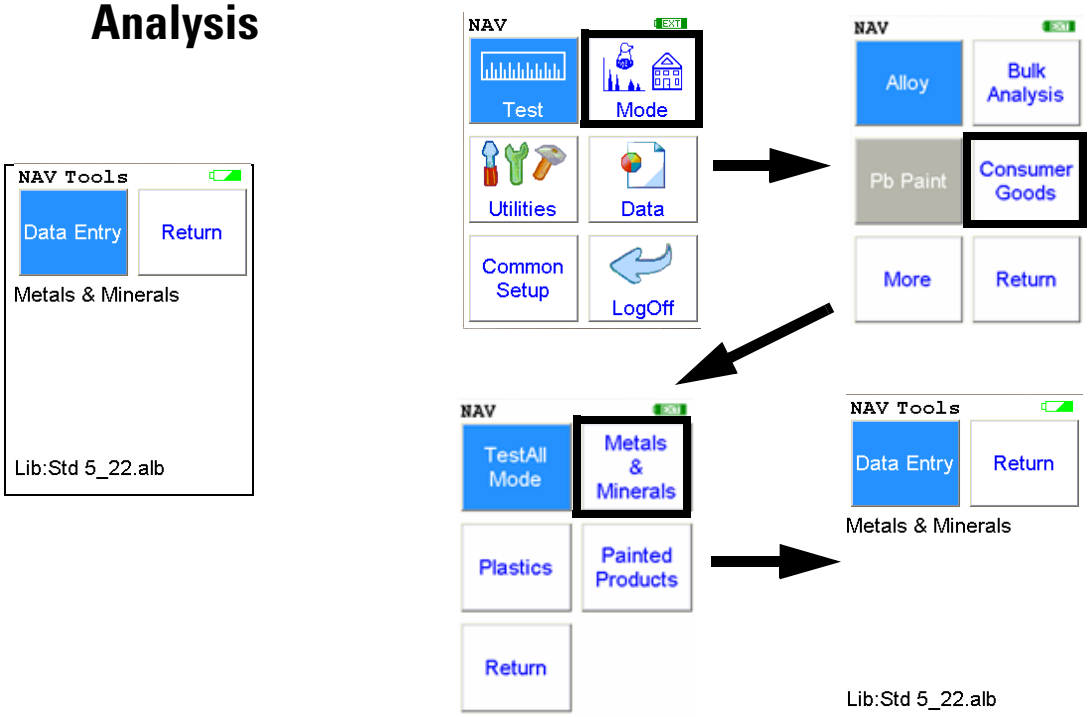


Figure 1-8. Metals & Minerals Menu Path

To access the **Metals & Minerals Test Menu**, select the **Metals & Minerals Mode** icon from the **Consumer Goods Analysis Menu**. From the **Metals & MineralsTest Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **Metals & Minerals Test Menu** to go to "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

Use **Metals & Minerals Mode** when your sample is unpainted metal, soil, or ceramic.

Consumer Plastics Analysis

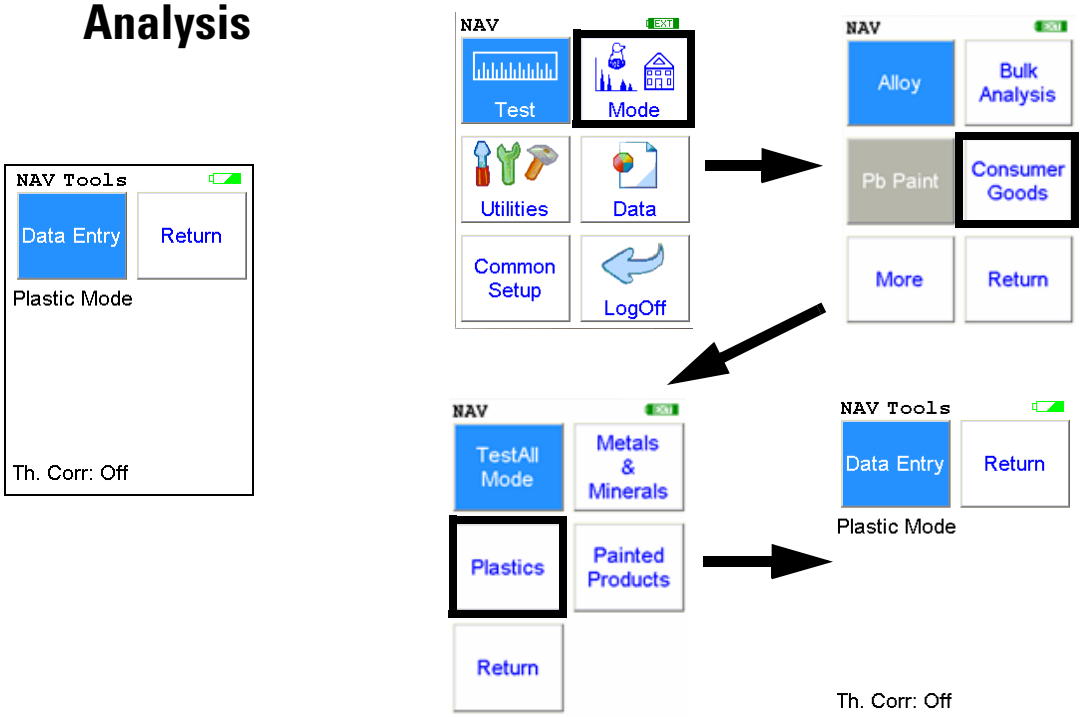


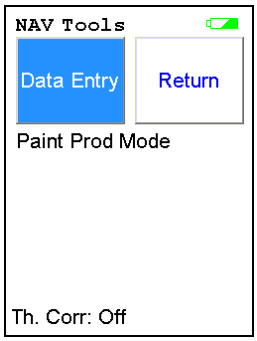
Figure 1-9. Plastics Menu Path

To access the **Plastics Test Menu**, select the **Plastics Mode** icon from the **Consumer Goods Analysis Menu**. From the **Plastics Test Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **Plastics Test Menu** to go to "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

Use **Consumer Plastics Mode** when your sample is plastic - PVC or non-PVC.

Painted Products Analysis



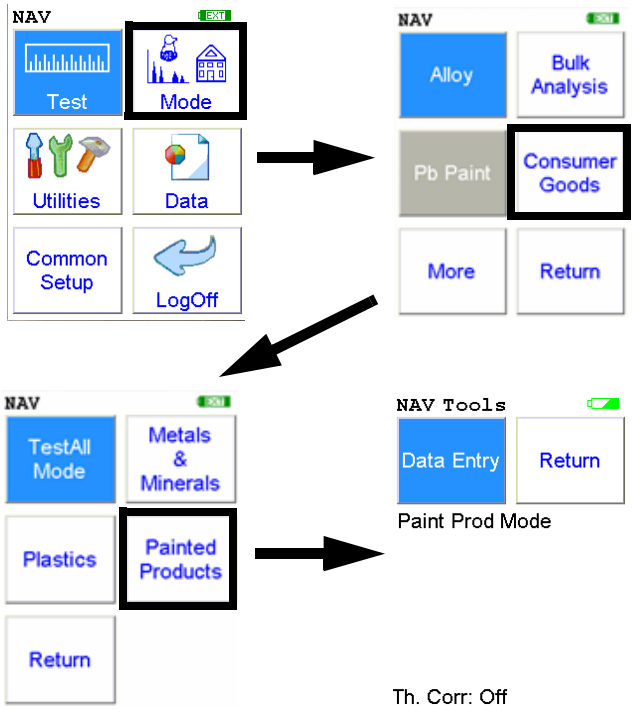


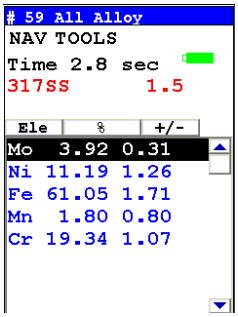
Figure 1-10. Painted Products Menu Path

To access the **Painted Products Test Menu**, select the **Painted Products Mode** icon from the **Consumer Goods Analysis Menu**. From the **Painted Products Test Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **Painted Products Test Menu** to go to "The Data Entry Screen" on page 1-50, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

Use **Painted Products Mode** for analysis of goods with a paint layer over a substrate. If lead is found to be on the surface, it will be reported in units of µg/cm^2. All other elements will be reported in units of mg/kg or %.

The View Data Screen



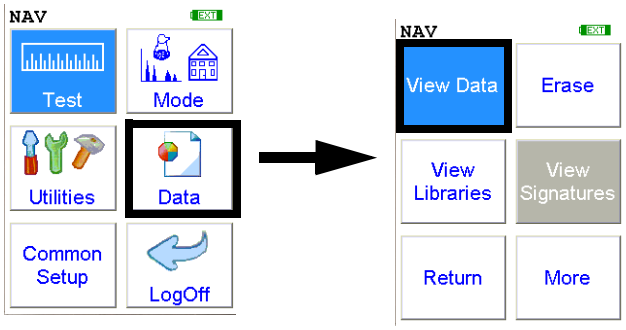
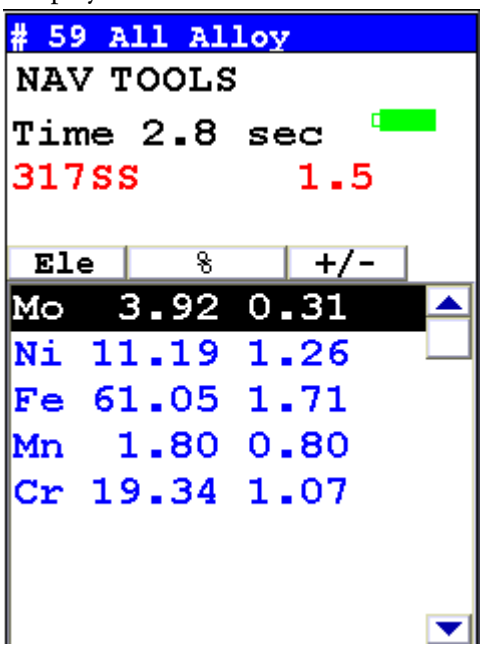


Figure 1-11. The View Data Menu Path

Use the Data Screen to view previously taken test result readings. When the **View Data** icon is selected, the Results screen of your most recent test is shown on the LCD display.



Using the buttons on the control panel, you may view different readings or additional data for individual readings.

Your analyzer will display the standard screen analysis. Pressing the "Down" arrow on the 4-way touch pad will display a complete scrolling elemental chemistry listing. Each press of the “Down” arrow scrolls the screen down to the next element. You can also use the scroll bar along the right side to scroll or page through the elements.

Scrolling Down Through the Complete Listing of Elements

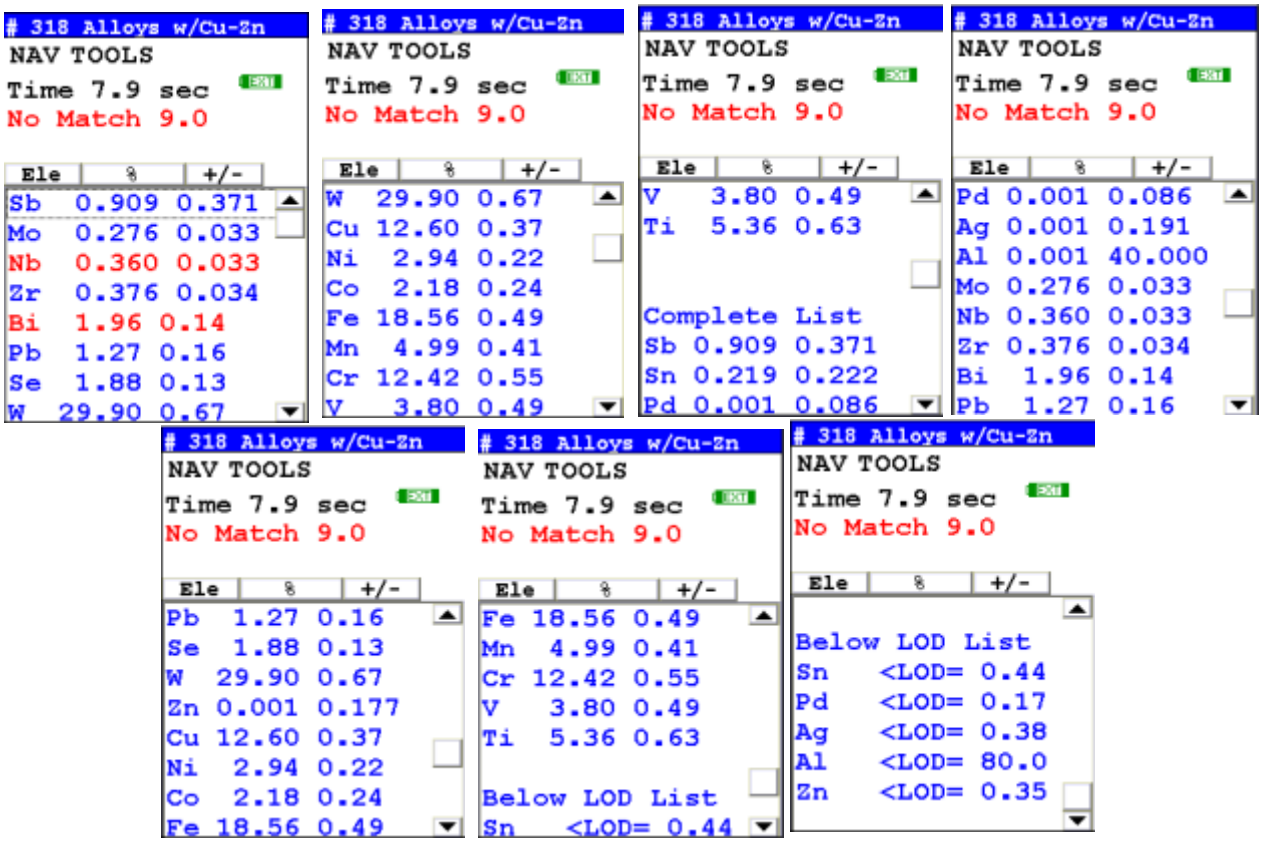


Figure 1-12. Complete Listing of Elements

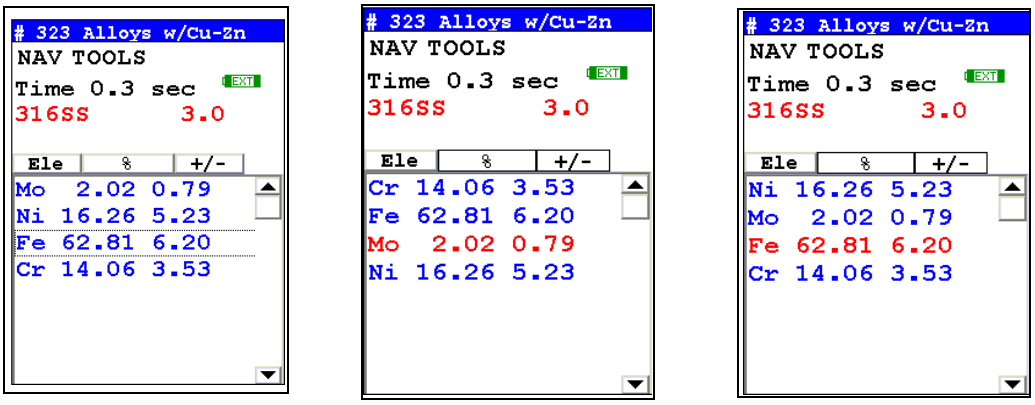
Pressing the "Left" arrow on the 4-way touch pad of your analyzer will display the previous reading, or if the first reading is currently displayed, the last reading. Pressing the "Right" arrow on the 4-way touch pad will display the next reading, or if the last reading is currently displayed, the first reading in memory. NITON Analyzers can store between 3000 to 6000 readings.

You can also look at the complete x-ray spectra for each reading stored in the analyzer's memory.

Sorting Elements

You can sort element rows by various criteria in order to view your data in the manner you prefer.The Sort Buttons, which double as column headings, can be used to re-sort the data in different ways. The Data Screen always begins as a Standard Sort, as you have defined it. Selecting the appropriate

sort button once toggles the sort order to High-to-Low. Selecting the sort button again toggles the sort order to Low-to-High. To return to the Standard Sort, view a different reading and return.



Standard Sort | Low-to-High Sort | High-to-Low Sort

Figure 1-13. Element Sorts

Element Sorts

Element sorts are performed alphabetically based on the element name.

Composition Sorts

Composition sorts are performed numerically based on the percentage of composition.

Error Sorts

Error sorts are performed based on the range of error in the reading.

Spectrum Graph

For any reading result, simply use the **NAV Menu** to gain access to the reading's spectrum graph. Selecting Spectra will show a graphed spectrum of this reading, called SpectraView. SpectraView can be a useful tool for rapid, qualitative analysis of a sample. See "SpectraView" on page Appendices-vii for details.

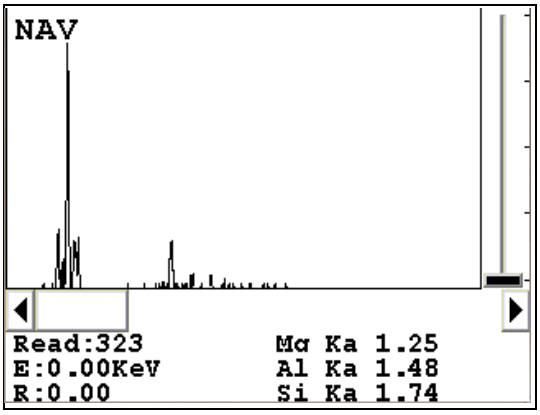


Figure 1-14. The SpectraView Screen

The Erase All Data Screen

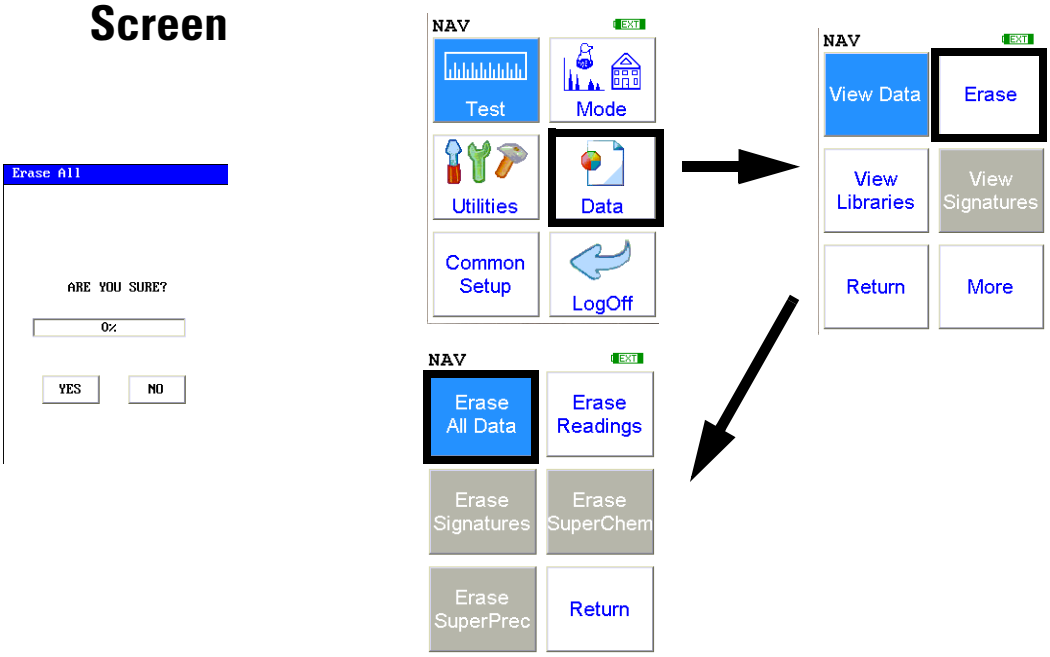


Figure 1-15. The Erase All Data Menu Path

Select the **Erase All Data** icon to erase all data, including signatures and SuperChem reference readings, from your analyzer. Selecting the **Erase All Data** icon will bring up a confirmation screen (see upper left) asking you "Are you sure?" with options to select "YES" or "NO". Selecting "YES" will erase all reading data from your analyzer. Selecting "NO" will return you to the **Erase Menu**.

CAUTION Never turn off the analyzer while data is being erased! ♦

WARNING! Do not attempt to take measurements while downloading readings! This will generate an error requiring a system reset, and may corrupt your stored readings, requiring all stored readings to be erased. ♦

The Erase Readings Screen

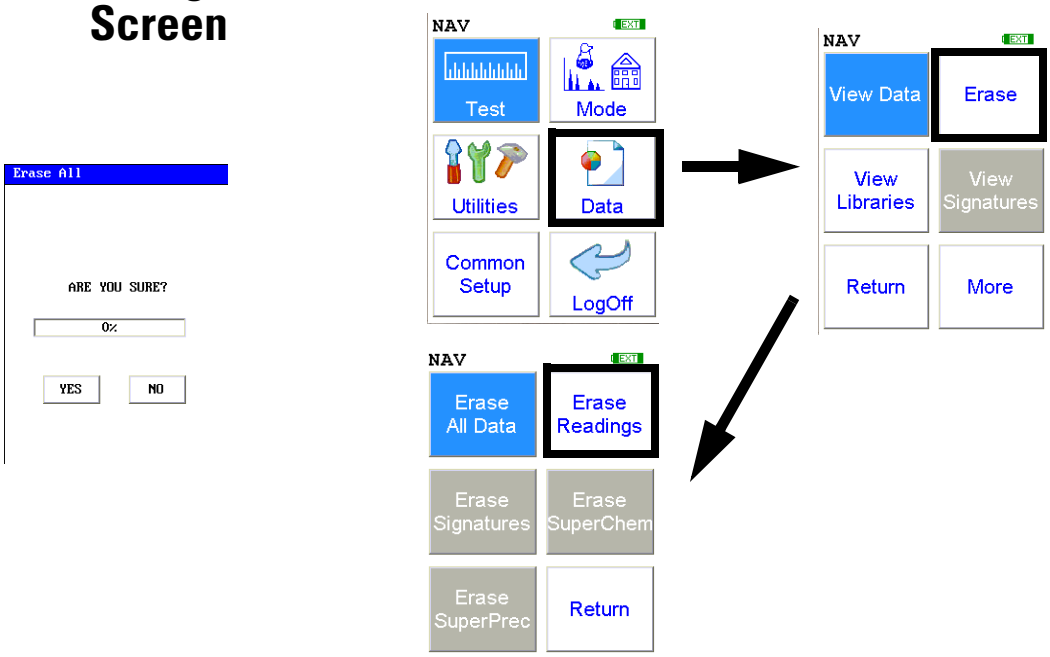


Figure 1-16. The Erase Readings Menu Path

Select the **Erase Readings** icon to erase all accumulated test readings from your analyzer. Selecting the **Erase Readings** icon will bring up a confirmation screen (see upper left) asking you "Are you sure?" with options to select "YES" or "NO". Selecting "YES" will erase all test reading data from your analyzer. Selecting "NO" will return you to the **Erase Menu**.

Note We recommend that you download all your readings into an NDT file for recording purposes before erasing all data. ♦

The Erase Signatures Screen

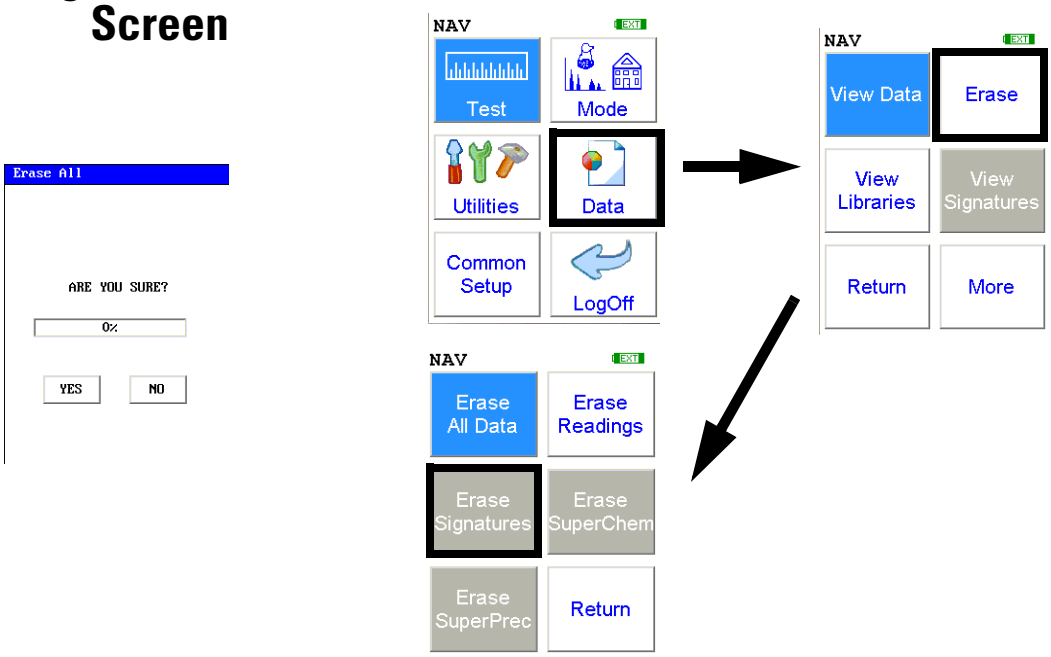


Figure 1-17. The Erase Signatures Menu Path

Select the **Erase Signatures** icon to erase all accumulated alloy signatures from your analyzer. Selecting the **Erase Signatures** icon will bring up a confirmation screen (see upper left) asking you "Are you sure?" with options to select "YES" or "NO". Selecting "YES" will erase all signature data from your analyzer. Selecting "NO" will return you to the **Erase Menu**.

The Erase SuperChem Screen

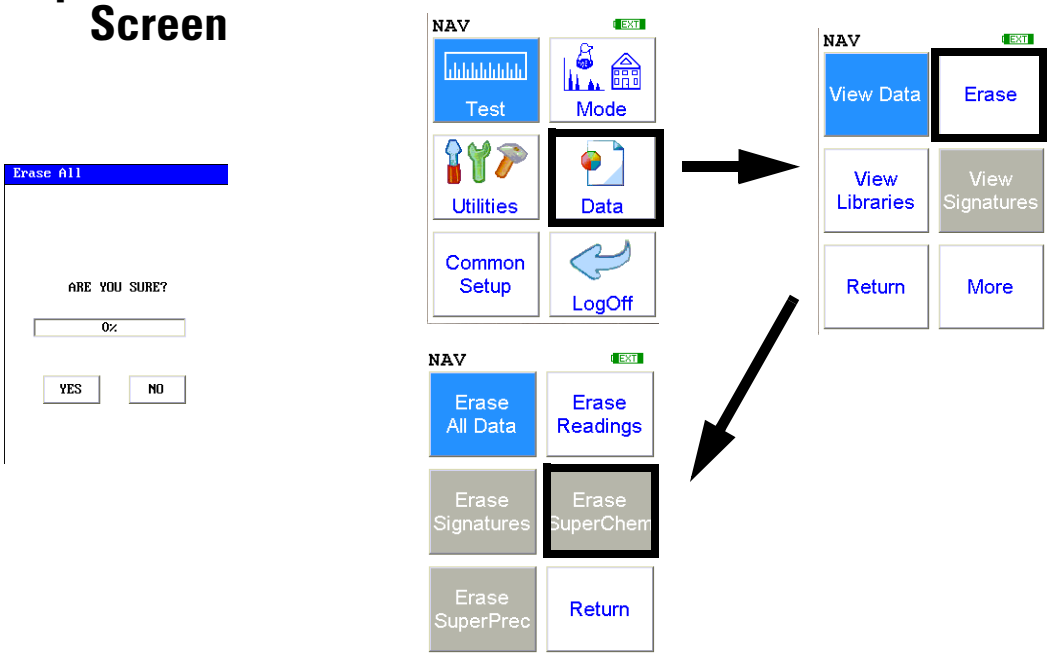


Figure 1-18. The Erase SuperChem Menu Path

Select the **Erase SuperChem** icon to erase accumulated SuperChem reference readings from your analyzer. Selecting the **Erase SuperChem** icon will bring up a confirmation screen (see upper left) asking you "Are you sure?" with options to select "YES" or "NO". Selecting "YES" will erase all SuperChem reference reading data from your analyzer. Selecting "NO" will return you to the **Erase Menu**.

The Erase SuperPrec Screen

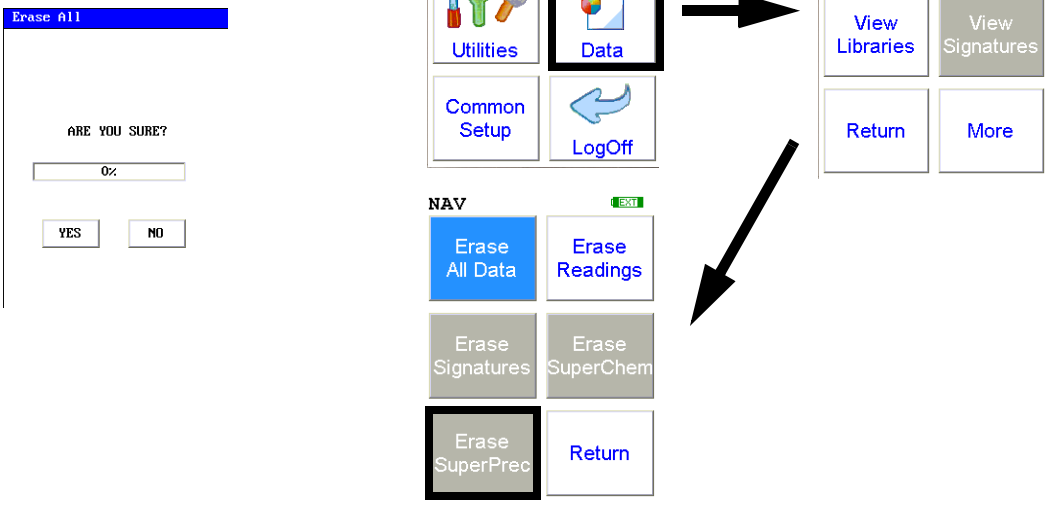


Figure 1-19. The Erase SuperPrec Menu Path

Select the **Erase SuperPrec** icon to erase accumulated SuperPrec reference readings from your analyzer. Selecting the **Erase SuperPrec** icon will bring up a confirmation screen (see upper left) asking you "Are you sure?" with options to select "YES" or "NO". Selecting "YES" will erase all SuperPrec reference reading data from your analyzer. Selecting "NO" will return you to the **Erase Menu**.

The View Libraries Menu

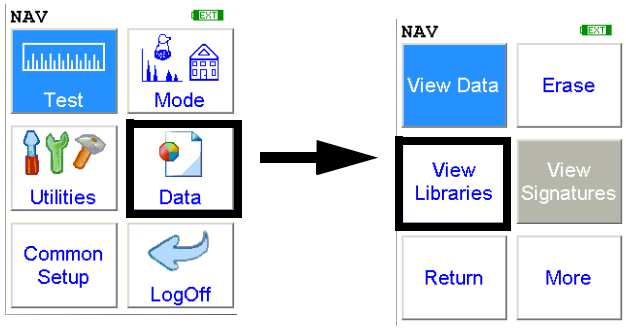


Figure 1-20. The View Libraries Menu Path

Select the **View Libraries** icon to access the **Library View Menu**. The **Library View Menu** allows you to view data in the Alloy Grade Library as well as the Superlib and Superstds libraries. Just select the library you wish to view from the list on screen.

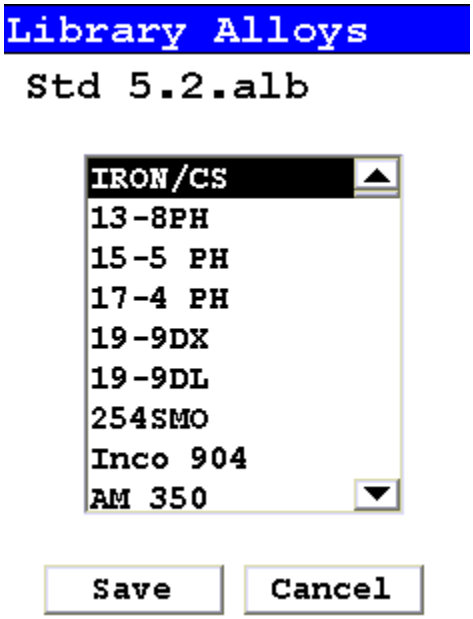
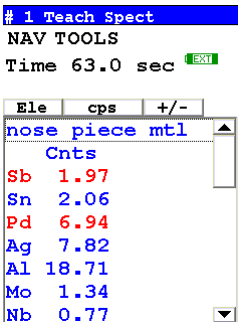


Figure 1-21. Viewing the Alloy Grade Library

The entries in the Grade Library serve as a reference for chemistry based analysis. The library entries allow the analyzer to work properly “out of the box” without needing time-consuming pre-analysis. Please refer to the NDT User Guide for information on modifying the Grade Library.

The View Signatures Menu



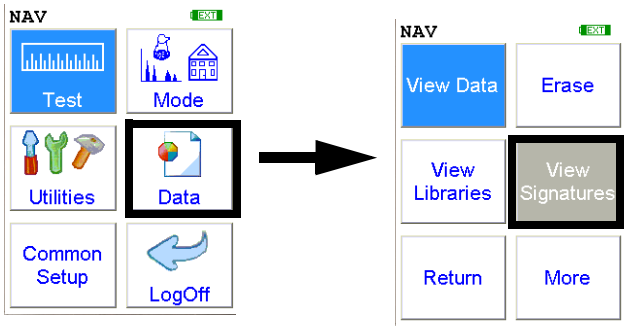
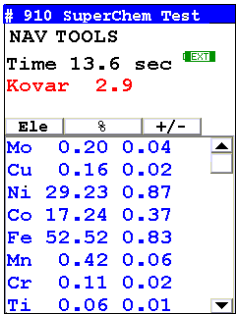


Figure 1-22. The View Signatures Menu Path

Select the **View Signatures** icon to view data saved as reference sample signatures in Signature ID Mode. When the **View Signatures** icon is selected, the Results screen of your most recent test is shown on the LCD display.

The View SuperChem Screen



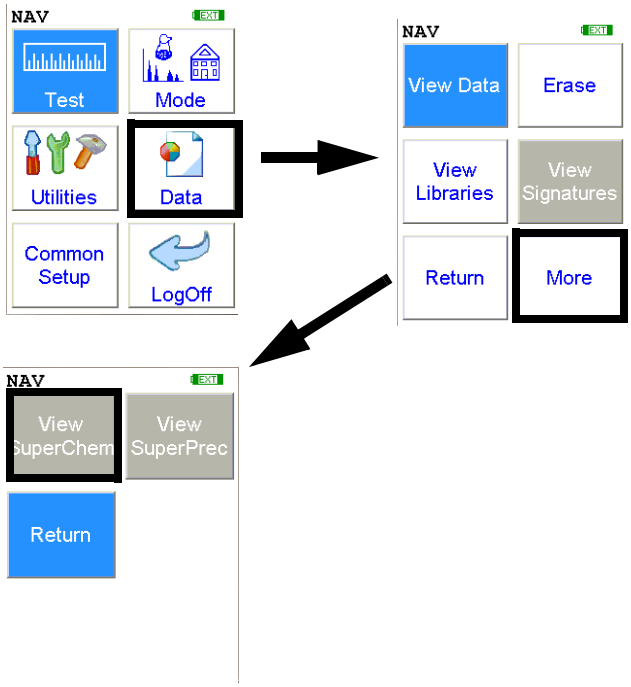


Figure 1-23. The View SuperChem Menu Path

Select the **View SuperChem** icon in order to view your SuperChem data. The **View SuperChem** icon allows you to view your **SuperChem Mode** data, and also allows you to delete individual readings.When the **View SuperChem** icon is selected, the Results screen of your most recent **SuperChem Mode** test is shown on the LCD display.

The View SuperPrec Screen

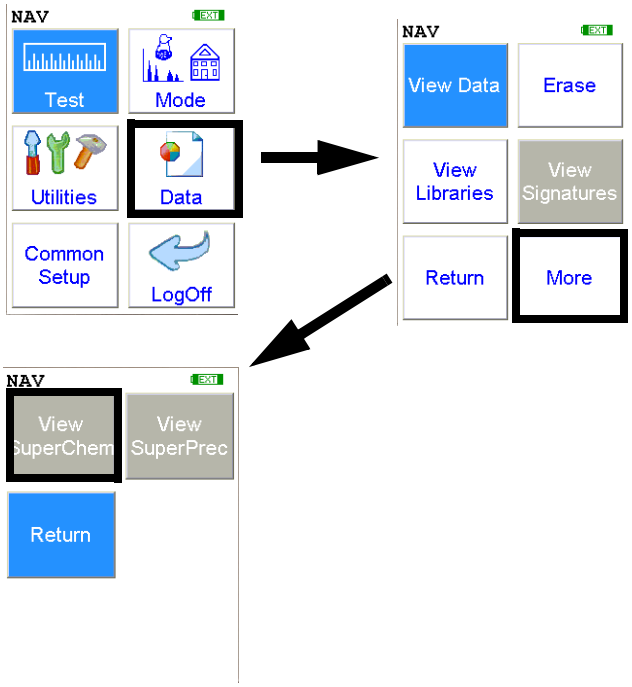
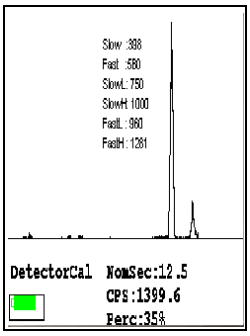


Figure 1-24. The View SuperPrec Menu Path

Select the **View SuperPrec** icon in order to view your SuperPrec data. The **View SuperPrec** icon allows you to view your **SuperPrec Mode** data, and also allows you to delete individual readings.When the **View SuperPrec** icon is selected, the Results screen of your most recent **SuperPrec Mode** test is shown on the LCD display.

The Calibrate Detector Screen



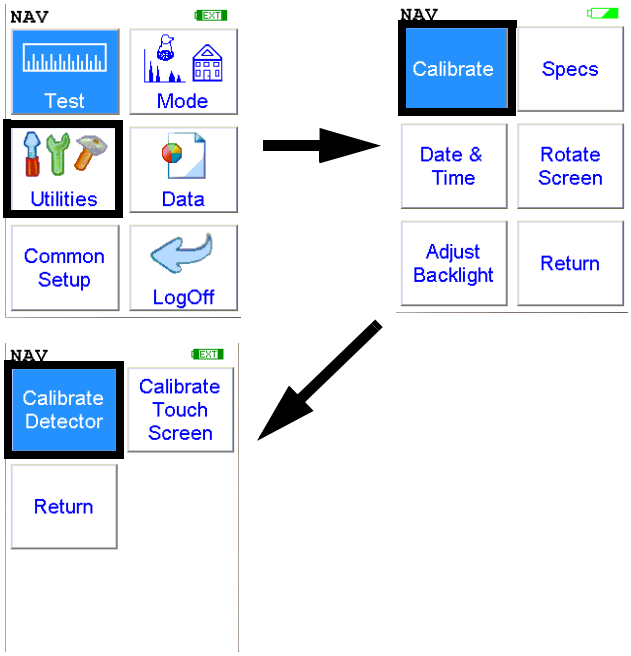


Figure 1-25. The Calibrate Detector Menu Path

Select the **Calibrate Detector** icon to begin a standard calibration of your analyzer's detector. Once you select the **Calibrate Detector** icon, calibration will begin immediately. The analyzer is programmed to calibrate for a specific, predetermined period in order to ensure proper operation of your NITONXL3 analyzer in the field.

CAUTION Avoid any vibration, loud noise, strong electronic fields, or other possible interference when your analyzer is calibrating its detector. ♦

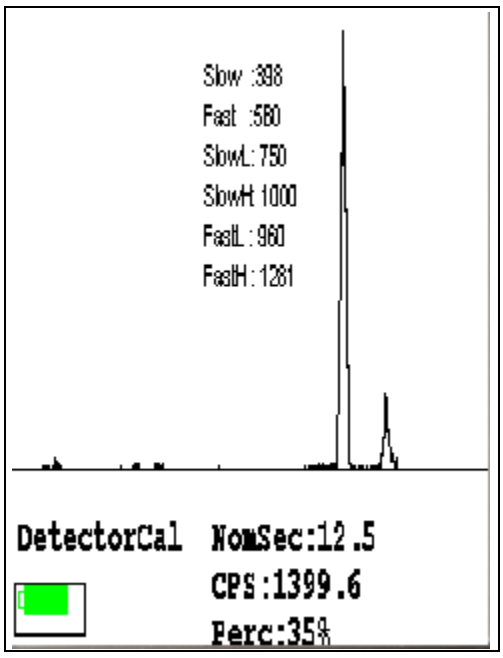


Figure 1-26. Detector Calibration Screen

The analyzer calibration screen will be displayed until calibration is complete. After the calibration has finished, the calibration results will be displayed. Press the on/off/escape button or the **Return** icon to return to the **Main Menu**. In order to insure good test results, it is essential that you calibrate your XL3 Analyzer's detector daily, and if a check sample test reveals discrepancies in the reading.

The Calibrate Touch Screen Screen

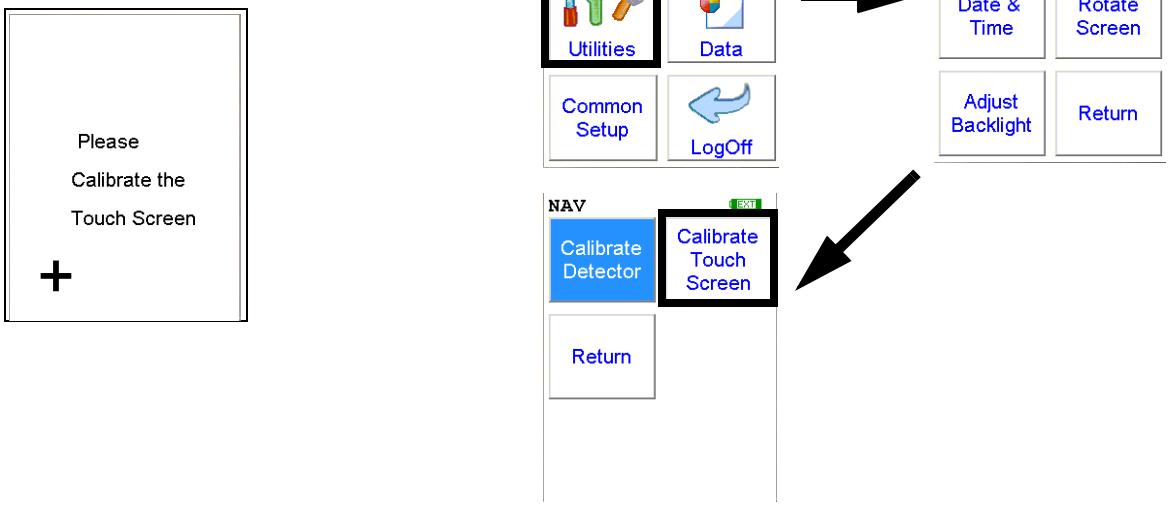


Figure 1-27. The Calibrate Touch Screen Menu Path

Select the **Calibrate Touch Screen** icon to re-calibrate the analyzer's touch screen display. This procedure establishes the display boundaries for the touch screen interface. When the **Calibrate Touch Screen** icon is selected, the display will show the message: "Calibrate Touch Screen". There will be a small cross in the upper left-hand corner of the display. Tap on this cross with the stylus, and the cross will disappear and reappear in the upper right-hand corner of the screen. Tap on the cross again, and it will reappear in the lower right-hand corner of the screen. Tap on the cross again and it will reappear in the lower left-hand corner of the screen. Tap on the cross once more, and you will be presented with the **Calibrate Menu**

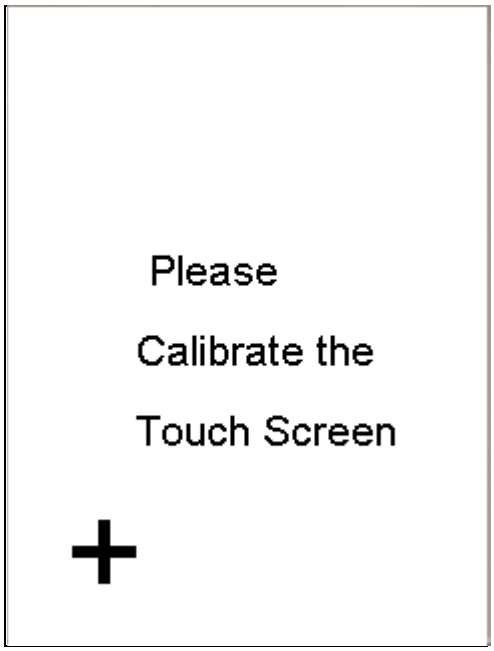


Figure 1-28. The Touch Screen Calibration Screen

Calibrating the Touch Screen Without Using the Touch Screen

Because there may be a severe issue with the touch screen itself, you may need to use the buttons below the screen to complete this process. There are 3 single buttons and a 4 way switch located to the rear of the display screen. The button at the left is the On/Off/Escape button. The button to the right is the enter button and the center keypad is a 4 way switch.

The 4 way switch has 4 positions, Up, Down, Left and Right. The select and interlock buttons are not used in this procedure.

Figure 1-29. The Control Buttons for the XL3

1. **Please, turn on your XRF analyzer using the On/Off button.**

Note From this point please DO NOT touch the touch screen.

2. **Press the enter button. You are now at the Radiation warning screen.**

3. **Using the 4 way touch pad on the on the cover of the instrument, move the cursor around the screen by pressing the appropriate Up down left or right button. Please move the cursor such that the Yes option is highlighted in green.**

4. **Press the “enter” button. You are now at the Enter Password Screen.**

5. **Move the cursor to the appropriate first number in your password and then using the enter button on the right (it has the arrow/enter key symbol on it) press this "enter" key. The first number of your password should appear in the lower left of the LCD screen.**

6. **Repeat step 5 until you have entered the entire password. Then move the cursor to the letter "E" and press the "enter" key to enter it.**

7. **You will now be at the main screen.**

8. **Again using the four way touch pad, move the cursor to highlight the "Utilities" icon and press the "enter" key to select.**

9. **You will now be at the Utilities screen**

10. **From the Utilities screen, move the cursor to highlight the "Calibrate" icon and press the "enter" key.**

11. **Now move the cursor to highlight "Calibrate Touch Screen" and press the enter key.**

12. **You are now at the Touch Screen Calibration screen.**

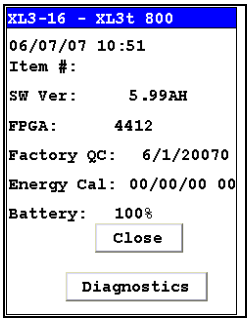
Note You must now use the touch screen for the balance of this procedure

13. **In the upper left hand corner you will see a crosshair "+", using the stylus or a pen, tap the center of the "+".**

14. **Repeat this for each "+" sign that appears, there should be one for each of the 4 corners.**

Your touch screen should work properly after this and you may use it from this point forward. If it does not, please repeat the process.

The Specs Screen



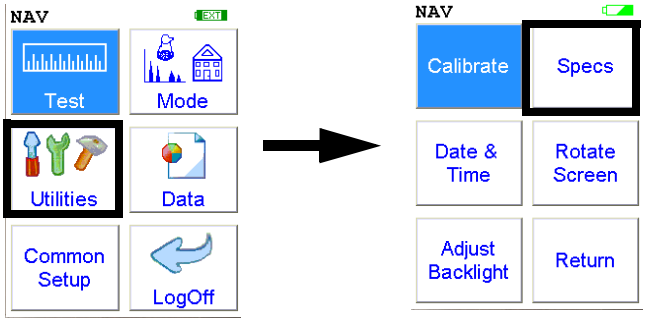
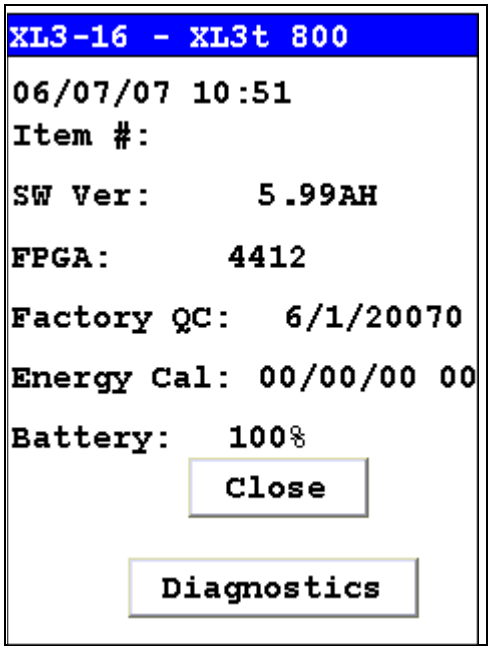
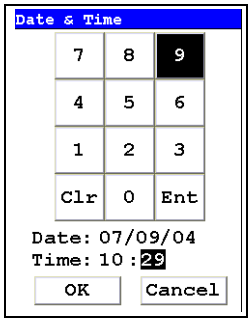


Figure 1-30. The Specs Menu Path

Select the **Specs** icon to display the analyzer's specifications. These specifications include your NITON analyzer's serial number, software and firmware versions, temperature, bias, and data coprocessors. Press the Close button to return to the Utilities Menu.



The Date and Time Screen



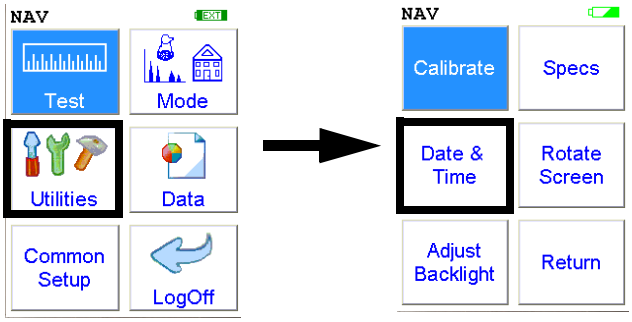


Figure 1-31. The Date and Time Menu Path

Select the **Date & Time** icon to set the date and time as needed for different time zones, daylight savings time, or any other reason. The date and time are factory preset prior to shipping. The format used is month/day/year - MM/DD/YY, and hour/minute - HH/MM, for the 24 hour clock.

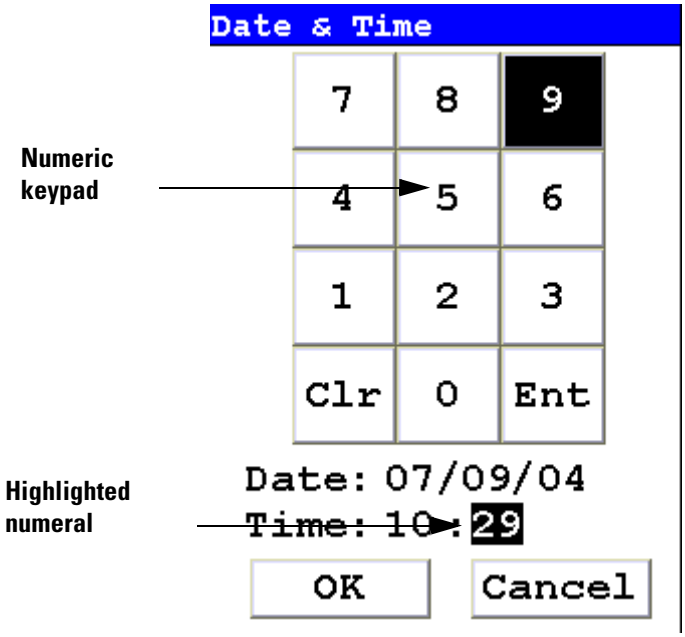


Figure 1-32. Setting the Date & Time

When the **Date & Time** icon is selected, the **Date & Time Screen** comes up on your analyzer's LCD Screen. Initially, the first character of the month is highlighted in reverse video (white on black), as in the sample display shown here. To change a character, select the digit you want to replace the character with from the virtual numeric keypad displayed on the screen,

then select the Enter (Ent) character from the virtual numeric keypad. Your analyzer will then accept the entry and automatically advance to the next digit. To skip a character, simply select the Enter (Ent) character from the virtual numeric keypad without selecting a replacement character.

For example, on the sample display, if you wish to change the "06" of the month to "07", the display appears with the first character (0) highlighted. Select the Enter (Ent) character to skip the zero. The "6" will now be highlighted. Select the "7" digit from the virtual numeric keypad, then select the Enter (Ent) key from the virtual numeric keypad. The change is accepted and the next digit is highlighted. Continue to select the Enter (Ent) symbol from the virtual numeric keypad to skip over the remaining characters of the date and time until the last character is reached. When you select the Enter (Ent) key from the virtual numeric keypad to confirm the last character, the word "SUCCESS" will appear beneath the Time field, and you will be returned to the Main Menu. The date is given in month/day/year format.

Note The analyzer will automatically return you to the **Main Menu** when the entry is complete. ♦

The Rotate Screen 180 Toggle

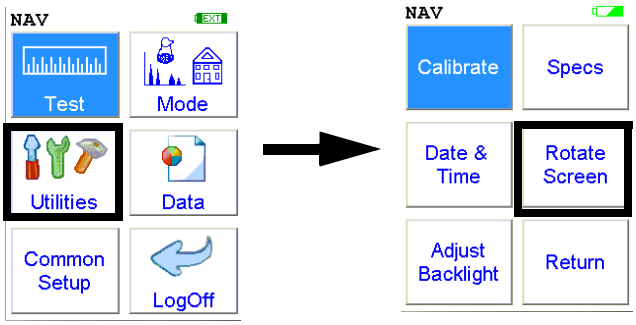
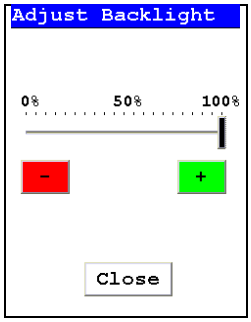


Figure 1-33. The Rotate Screen 180 Menu Path

Select the **Rotate Screen 180** icon to toggle the orientation of the screen between right side up and upside down.

The Adjust Backlight Screen



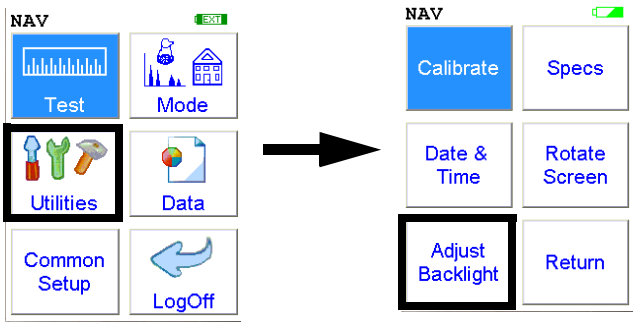
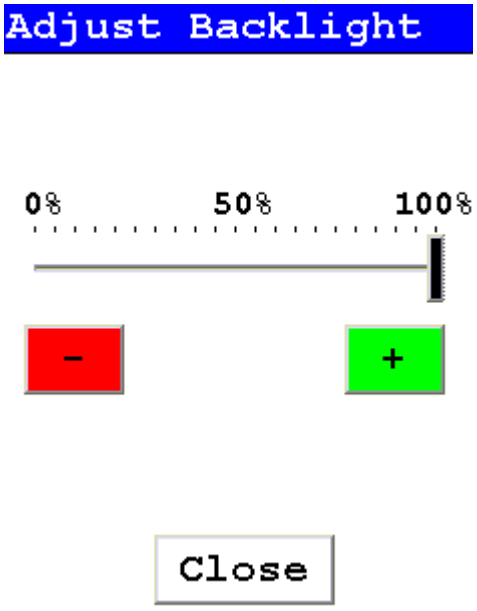


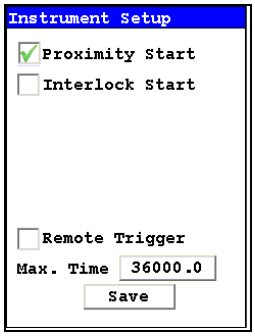
Figure 1-34. The Adjust Backlight Menu Path

Select the **Adjust Backlight** icon to adjust the brightness of the analyzer screen.



Selecting the red [-] box will cause the slider to move some to the left and the screen to dim a bit. Selecting the green [+] box will cause the slider to move a bit to the right and the screen to brighten somewhat. Find the setting most harmonious with the ambient lighting. Selecting Close saves the backlight setting in the current state, and returns you to the Utility Menu.

The Hardware Setup Screen



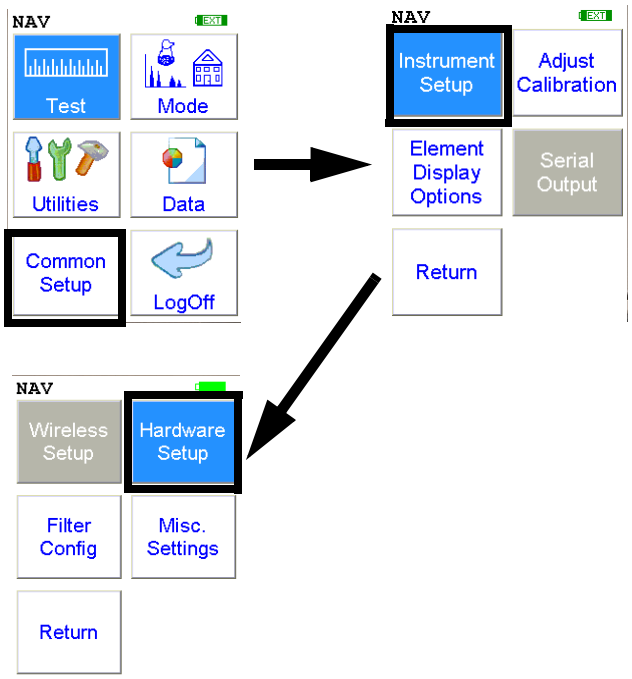


Figure 1-35. The Hardware Setup Menu Path

The **Hardware Setup Screen** enables you to toggle various options on or off, as well as select certain hardware dependant modes. Selecting an empty checkbox enables the option and places a check in the box. Selecting a checked box disables the option and clears the box.

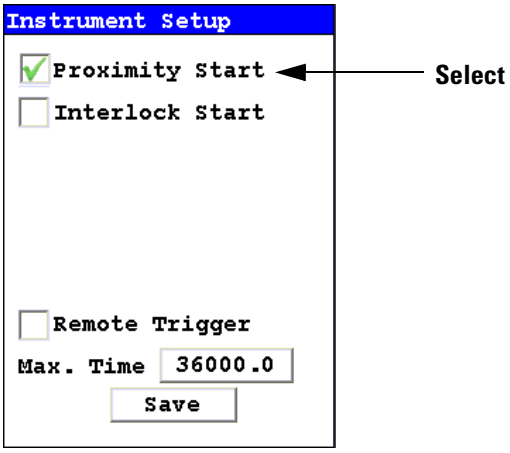


Figure 1-36. Selecting Options

Select the Proximity Start checkbox to toggle the use of the front proximity button. This enables the proximity button to be used to start taking a sample on contact. Some nations have laws or regulations which prohibit use of this feature. In this case, the feature will be disabled before shipping.

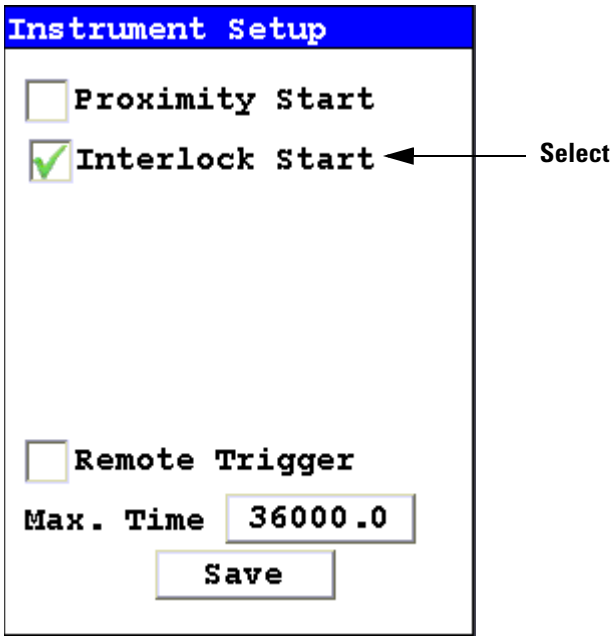


Figure 1-37. Selecting Interlock Start

Select the Interlock Start checkbox to toggle the use of the rear interlock button. This requires the interlock button to be used to start taking a sample on contact. Enabling the "Interlock Start" feature allows the user to start an analysis by depressing the rear interlock button on the analyzer.

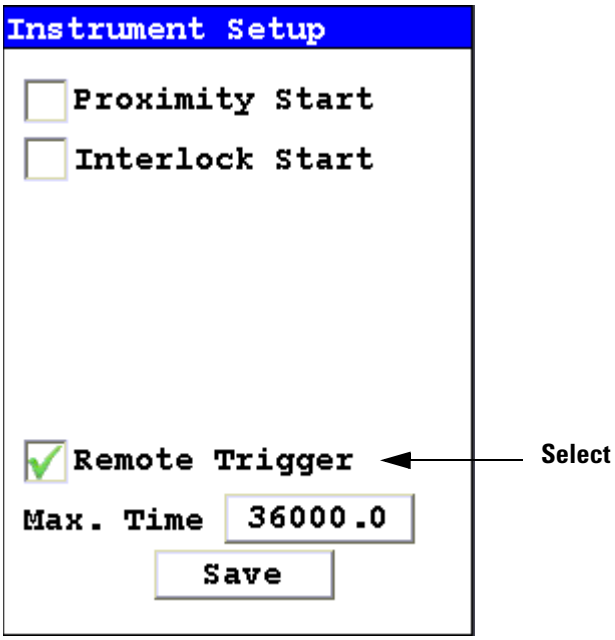


Figure 1-38. Selecting Remote Trigger

Select the Remote Trigger checkbox to toggle the use of the Remote Trigger. This is used when your XL3 is in a test stand or with the Extend-a-Pole. Enabling the "Remote Trigger" feature allows you to start an analysis by remote control.

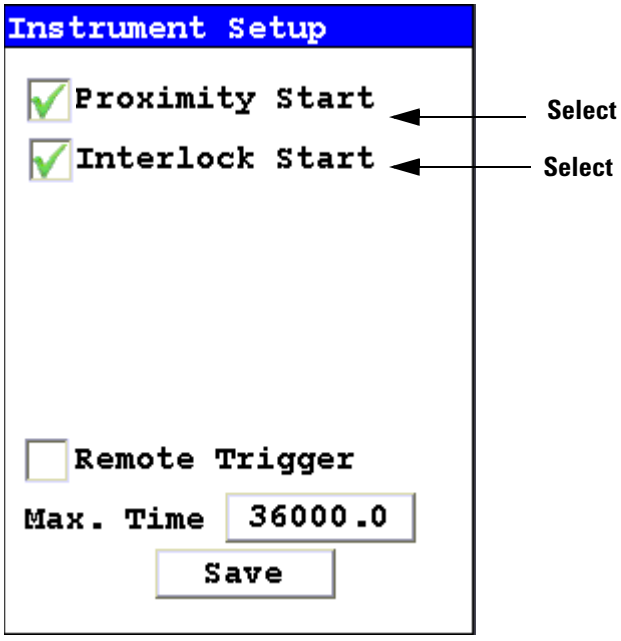


Figure 1-39. Selecting Option Combinations for Multiple Effects

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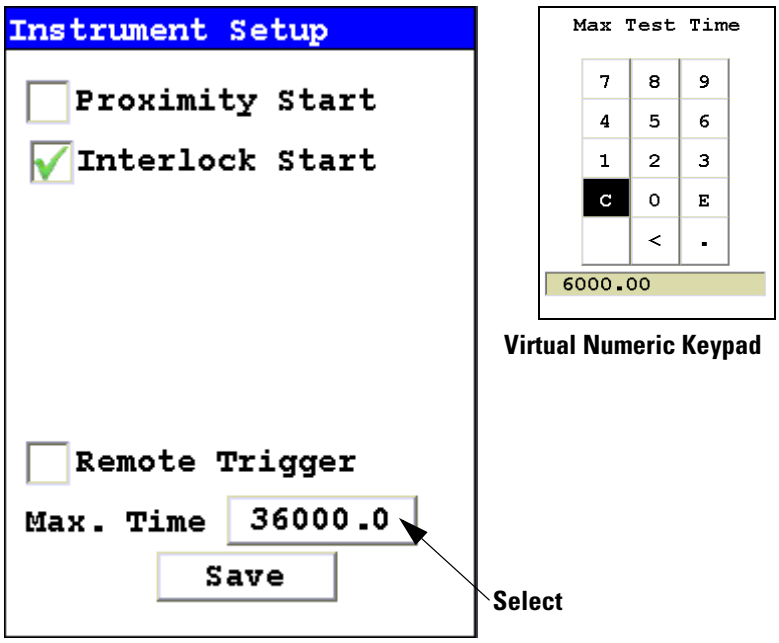
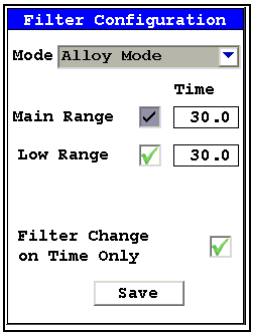


Figure 1-40. Changing the Max Time Parameter

Select the numbers box in the Max Time field to change the maximum seconds per reading. A virtual numeric keypad will appear, allowing you to set the number to whatever value you want, up to the maximum of 36000. When the max testing time is reached during an analysis, the analyzer reading will be automatically ended. Your analyzer will continue switching filters as needed until you terminate the reading or the Max Time is reached.

The Filter Config Screen



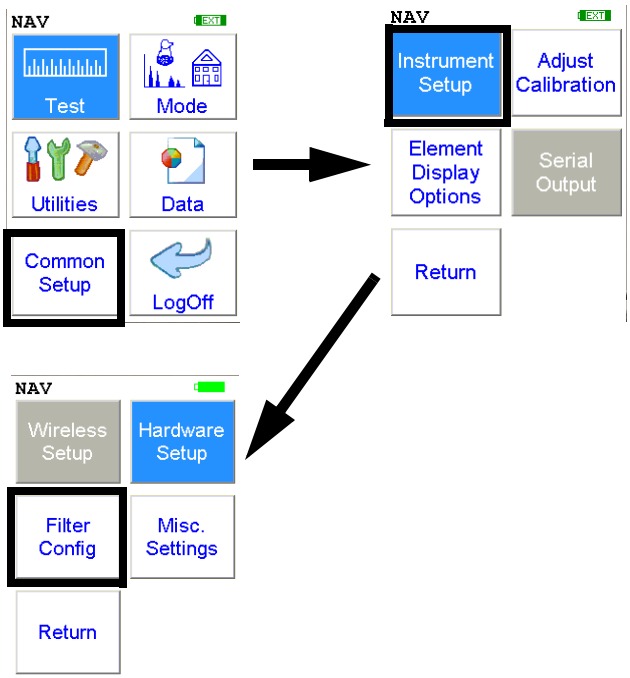


Figure 1-41. The Filter Config Menu Path

Multi-Filter tests are used to either preferentially excite specific elements for increased sensitivity, or to cover a wider element range than one filter alone can provide. Most modes, when enabled, will use two filters in sequence to produce a combined analysis result. In typical alloy analysis applications, Mid Range is used for the analysis of most elements, and Low Range is utilized for the subsequent high sensitivity analysis of V, Ti, and Cr. Multi-filter switching can be set to activate off time alone, or, when time switching is disabled, off settings in the alloy grade library. In environmental modes, Low Range adds the capability to analyze light elements which cannot be efficiently excited by Mid Range.

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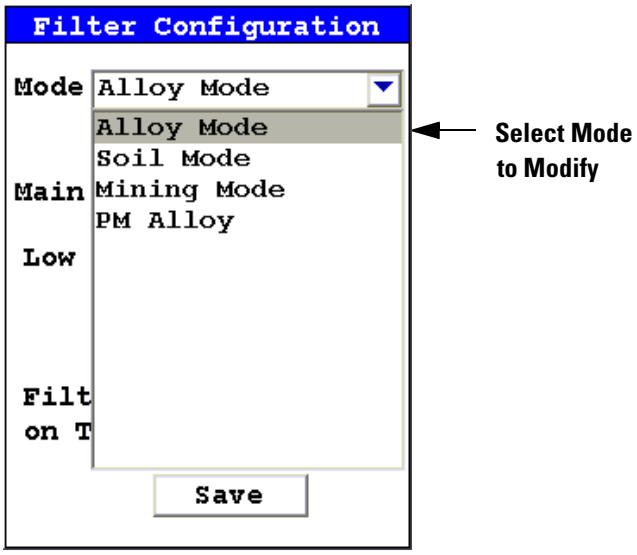


Figure 1-42. Selecting the Mode

Select the mode you wish to configure. You can set different configurations for different modes.

The **Filter Config Screen** enables you to directly enable or disable any filter, or control the time that a filter alters the irradiation of the sample before auto-switching to another filter.

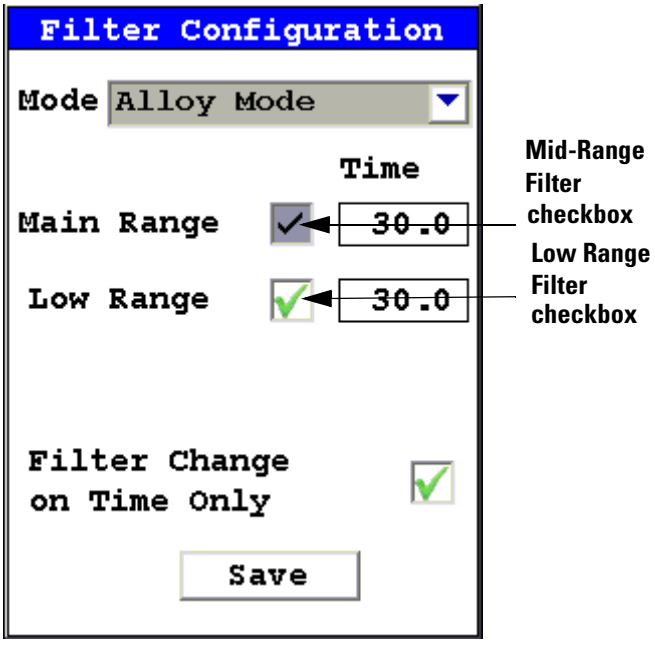


Figure 1-43. The Filter Checkboxes

Select the checkbox next to the filter you want to use to determine exactly which of the filters contained in your NITON Analyzer is used for sample testing. Selecting an empty checkbox will enable that filter and place a check into the box as an indicator. Selecting a checked box will disable the filter and clear the box.

In typical alloy analysis applications, Mid Range is used for the analysis of most elements

Low Range is utilized for the subsequent high sensitivity analysis of V, Ti, and Cr.

High Range is typically not used in alloy analysis.

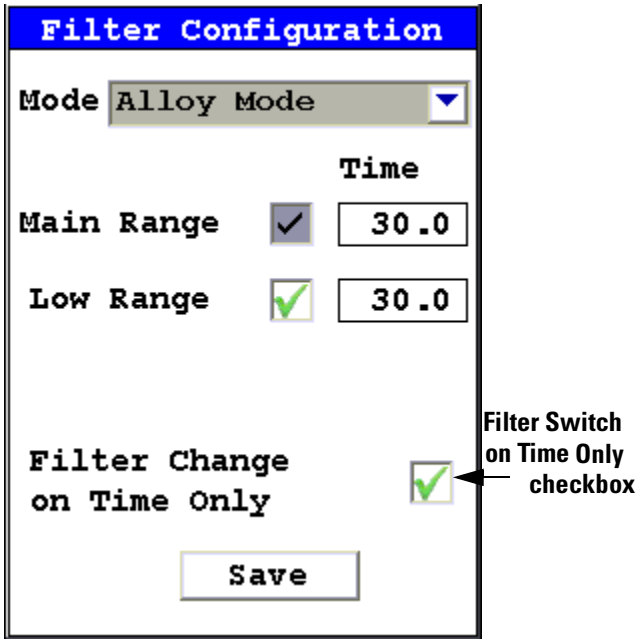


Figure 1-44. The Filter Switch on Time Only Checkbox

Select the Filter Switch on Time Only checkbox to toggle **Time Switch Only Mode** on or off. In **Time Switch Only Mode**, your NITON XL3 analyzer will ignore the Alloy Library and only switch filters according to the time interval you set in the Time field for each filter.

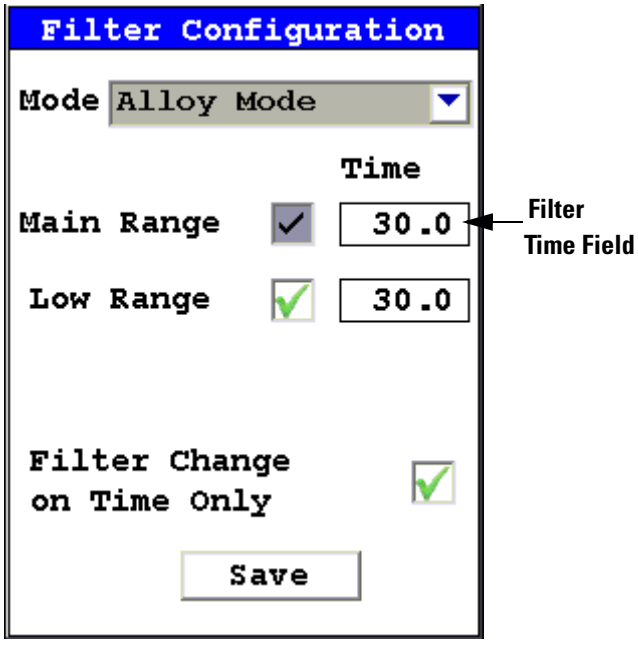


Figure 1-45. The Filter Time Fields

Select the Time field for the intended filter to change the filter switch time for that Filter. The Filter Time Editor will appear. This enables you to set the number of seconds each enabled filter is allotted before auto-switching will occur when needed during sample testing. Your analyzer will auto-switch from one filter to another when the testing time for that filter is greater than or equal to the time you have chosen, and the identified alloy is flagged as needing the switch in the NITON Alloy Library.

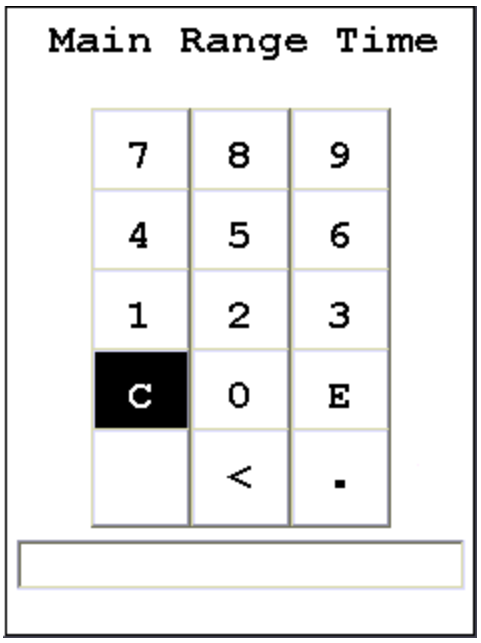
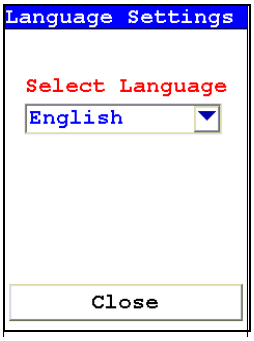


Figure 1-46. The Filter Time Editor

Select the “C” key to clear the current time, then from the virtual numeric key pad, select each digit you want to input, then select “E” to enter.

The Language Settings Screen



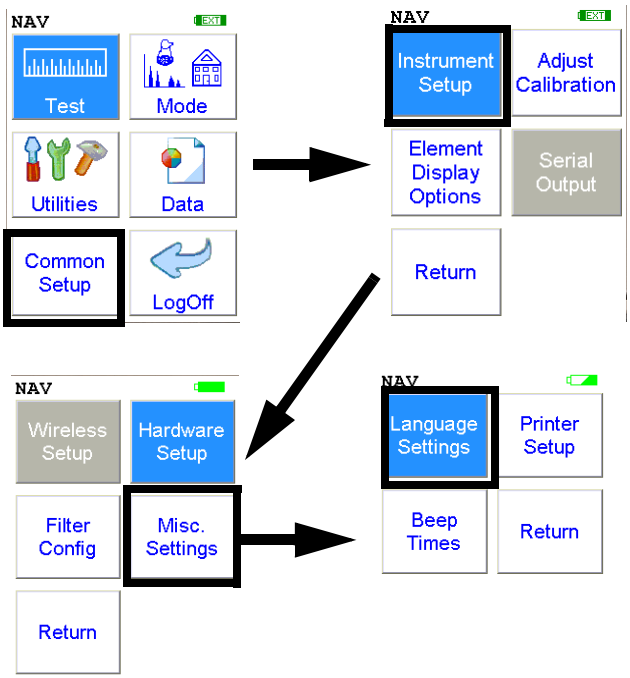


Figure 1-47. The Language Settings Menu Path

Selecting the **"Language Settings"** icon will load the **Language Screen,** allowing you to change the language from the default English to French, Spanish, Portuguese, or German.

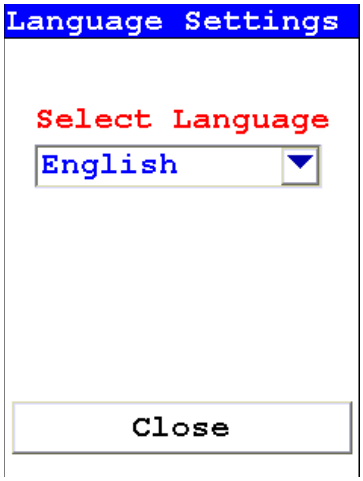


Figure 1-48. The Language Setting Screen

Select the down-pointing triangle, and then select the language you want from the drop down menu. The Menu system will now show on screen in the language you have selected.

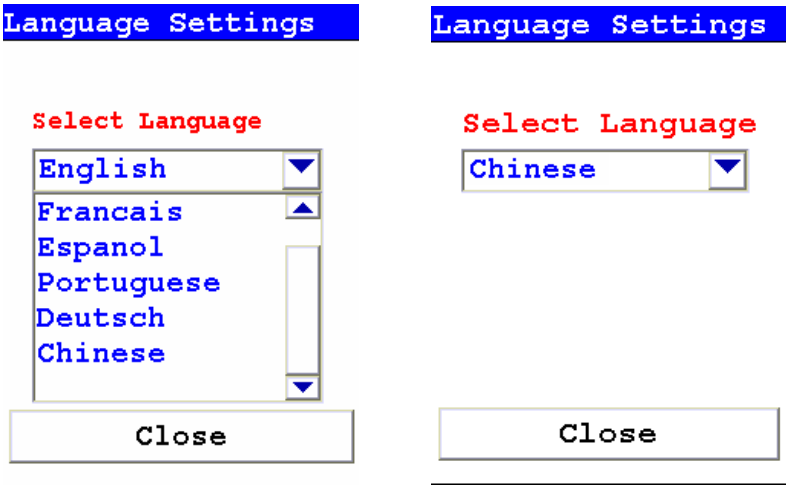
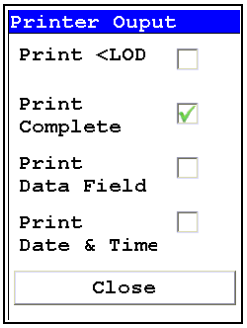


Figure 1-49. Selecting Language From the Drop Down Menu

Figure 1-50. The Main Menu in Chinese

The Printer Setup Screen



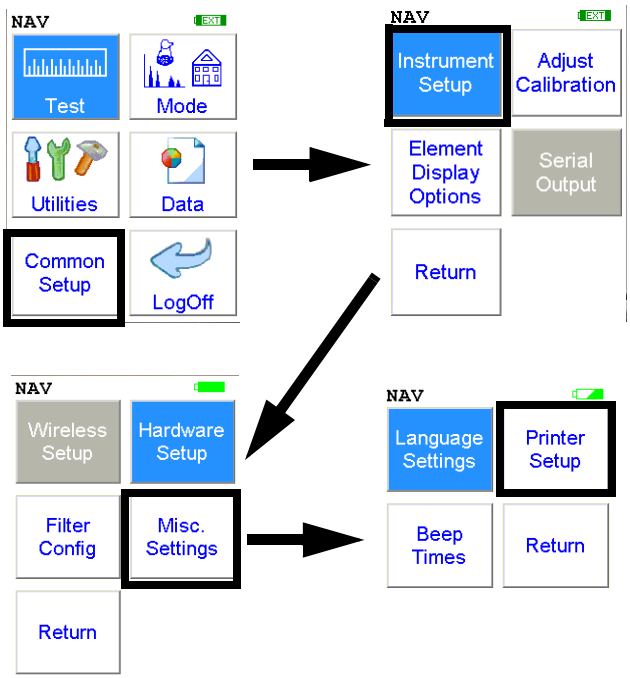


Figure 1-51. The Printer Setup Menu Path

The Printer Setup Screen allows you to adjust which sections of your reading data are sent to your optional printer. By default, your analyzer prints the detected list, reading number, reading length, reading mode and any applicable measurement data such as Alloy match grade names. You can select any combination of options on the Printer Setup Screen to change what is printed.

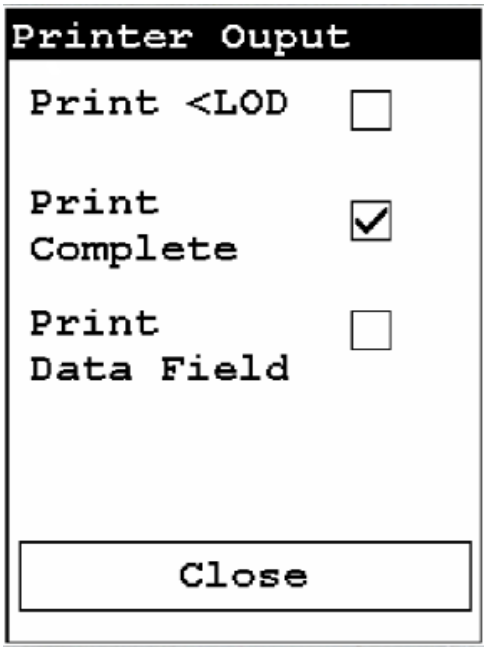


Figure 1-52. The Printer Setup Screen

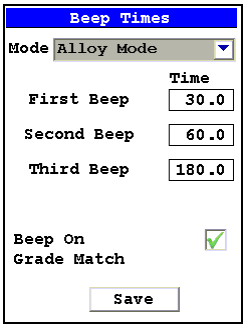
Print < LOD Selecting this option will enable printing of readings which are lower than the Limit of Detection.

Print Complete Selecting this option will enable printing of all the data fields in the reading.

Print Data Field Selecting this option will enable printing of all entered data fields.

Print Date & Time Selecting this option will enable printing of the Date and Time.

The Beep Setup Menu



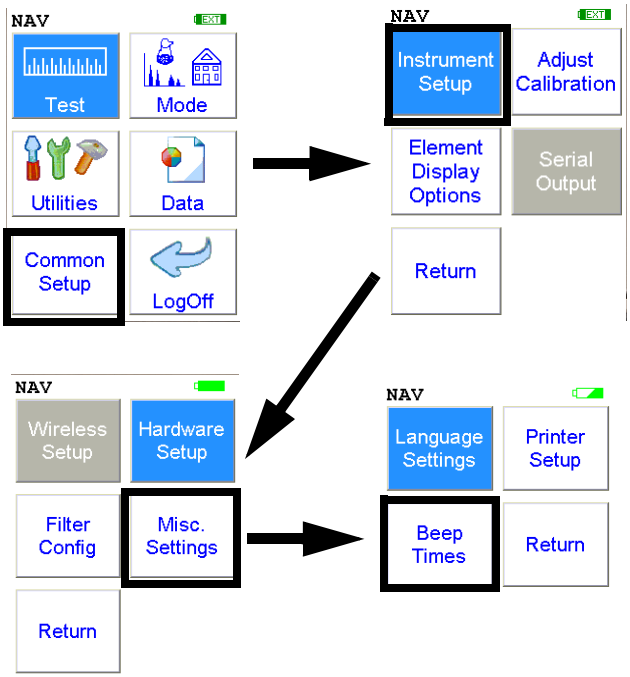


Figure 1-53. The Beep Setup Menu Path

Selecting the Beep Times icon opens the Beep Setup Screen, enabling changes to the beep settings for various modes. The beeps sound as follows:

- First Beep - a single short beep.
- Second Beep - two beeps with different frequencies
- Third Beep - three beeps with alternating frequencies
- Grade Match Beep - two beeps of the same frequency.

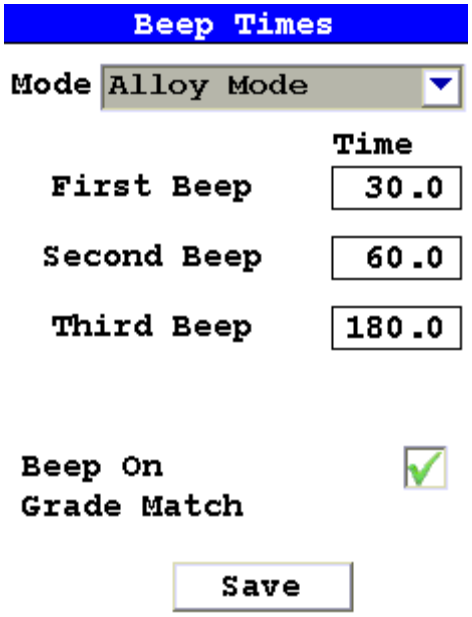


Figure 1-54. The Beep Setup Screen

Mode This option allows you to change the beep settings for different modes independently. Select the down arrow to access the list of modes.

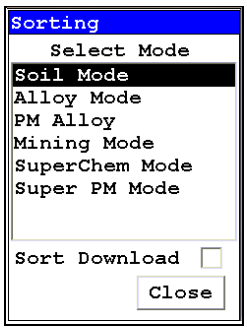
First Beep This option allows you to change the delay before the First Beep.

Second Beep This option allows you to change the delay before the Second Beep.

Third Beep This option allows you to change the delay before the Third Beep.

Beep on Grade Match Selecting this option will enable a special beep when the reading chemistry matches and alloy grade.

The Sort Element Display Menu



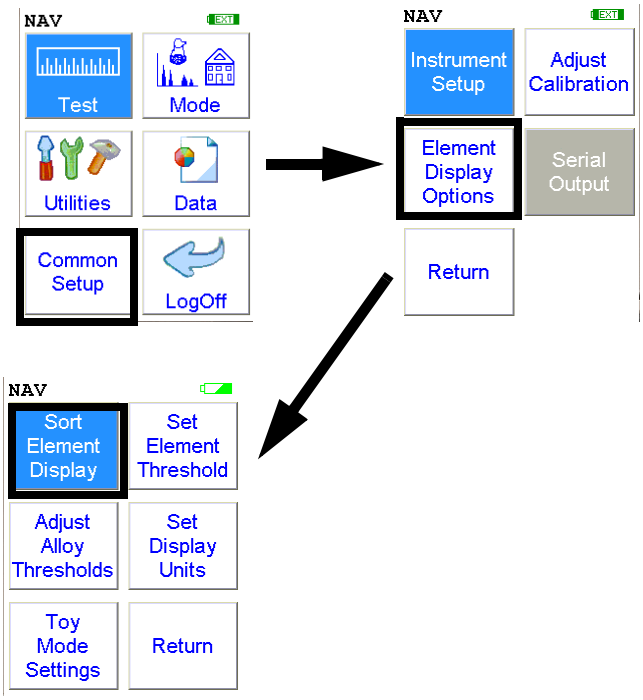


Figure 1-55. The Sort Element Display Menu Path

Select the **Sort Element Display** icon to configure sorting criteria used for analysis display. Selecting the **Sort Element Display** icon opens up the **Sort Criteria Screen**. Select the mode you wish to change, and the **Sorting Options Screen** will appear.

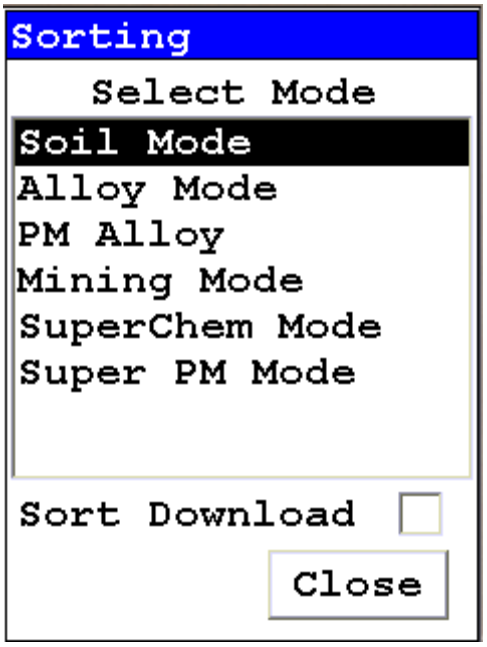


Figure 1-56. The Sort Element Display

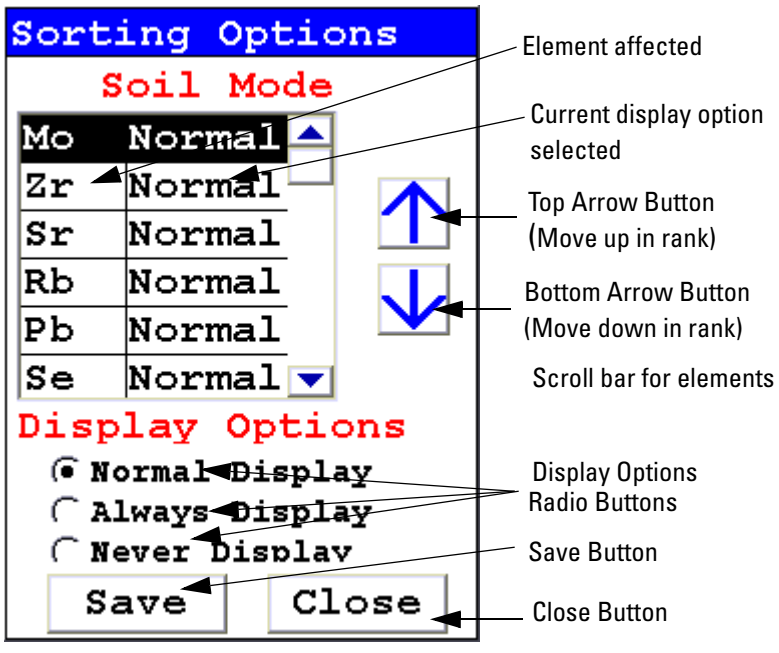


Figure 1-57. The Sorting Options Screen

On the left of the display are elements, each with its currently selected display option beside it to the right. The element list is ranked by importance, with the most important element on top, and each one lower down of less importance than the one above it.

By selecting an element and using the arrow buttons to the right of the list, you can change its ranking. Use the Top Arrow Button to move an element one rank closer to the top with each click. Use the Bottom Arrow Button to move an element one rank closer to the bottom with each click.

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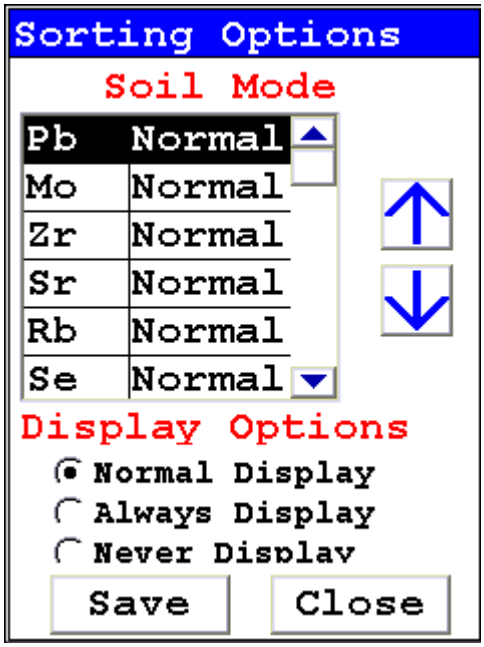


Figure 1-58. Changed Sort Order

The Display Options Radio Buttons allow you to change the display status of any element to one of three states:

- Normal - The standard state. Element displays only when the elemental value is greater than the limit of detection.
- Always - Always display the results for this element. Use this state for elements critical to all of your analyses.
- Never - Never display the results for this element. Use this state for elements which are unimportant to your work. This makes your instrument display less complex.

Select the element you want to change, then select the radio button corresponding to your choice of display status. The currently selected element is displayed in white on black.

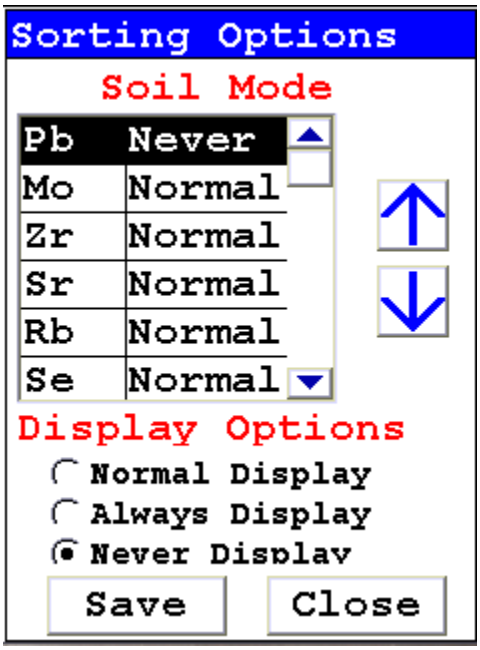


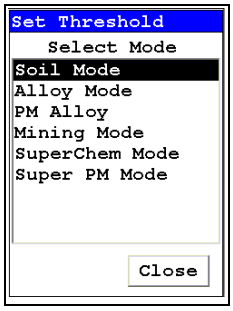
Figure 1-59. Changed Display Options

Select the Save Button to save your current status as the new default. After saving, you will go back to the **Element Display Menu**.

Select the Close Button to exit without saving. When you select the Close Button after changing the display state of any element, a screen will open asking you if you want to save the changes you made. Selecting "Yes" will save these changes as the new default. Selecting "No" will return you to the **Element Display Menu** without saving the changes.

Figure 1-60. Save Changes

The Set Element Threshold Menu



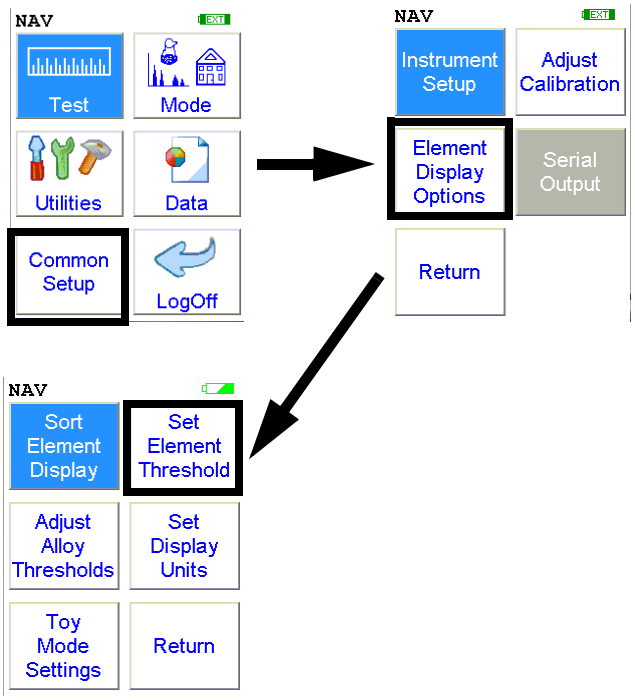


Figure 1-61. The Set Element Threshold Menu Path

Select the **Set Element Threshold** icon to configure pass and fail criteria for elemental analysis. Selecting the **Set Element Threshold** icon opens the **Set Threshold Screen**.

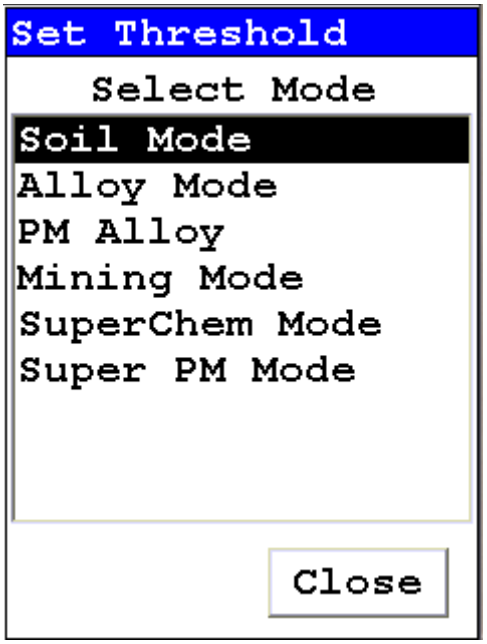


Figure 1-62. Set Threshold Screen

Select the mode you wish to work with from the scrollable list. This will open up the **Settings Screen** for that mode.

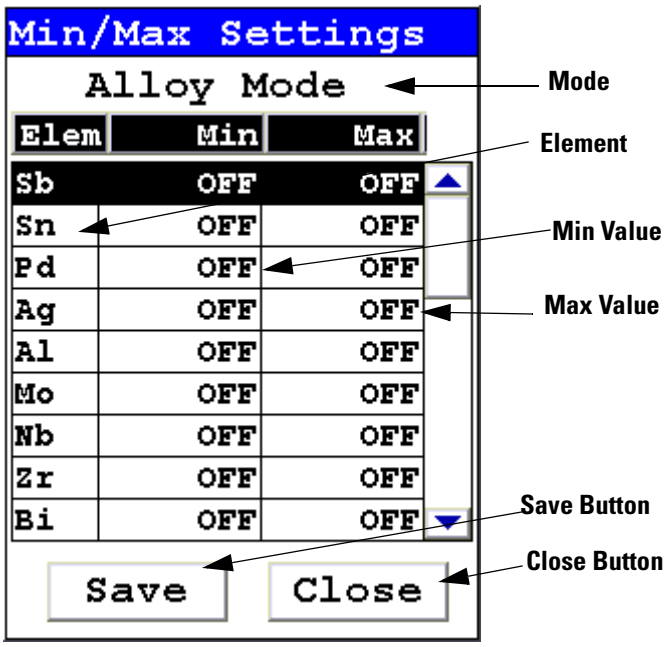


Figure 1-63. Min/Max Settings Screen

Selecting the Min Value will open up the Min Editor for the selected element.

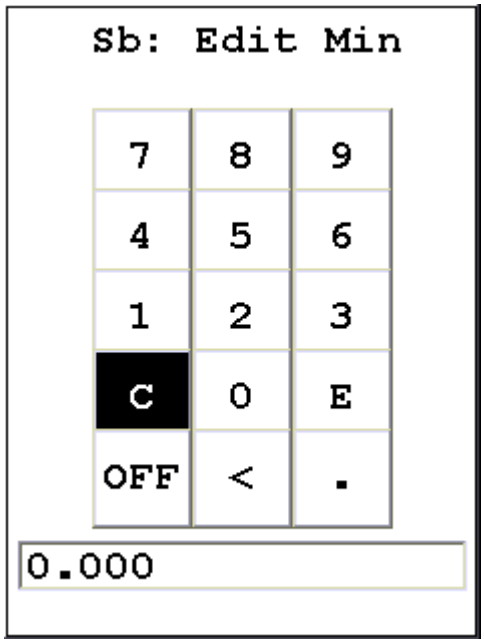


Figure 1-64. The Min Editor

The Editor is very similar to the Logon Screen. The “C” button clears the field, and the “<“ button clears the last numeral. Select the numerals you want, then press “E” to enter the number. “OFF” resets the value to “OFF”

Selecting the Max Value will open up the Max Editor for the selected element.

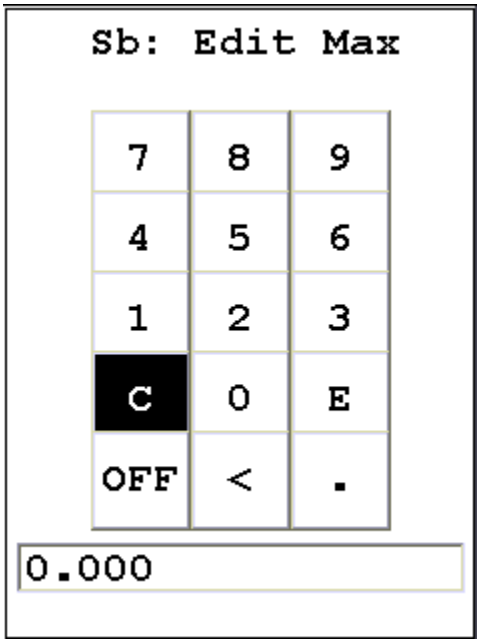


Figure 1-65. The Max Editor

The Max Editor works the same as the Min Editor.

When you press the “E” button in either editor, you are returned to the Min/Max Settings Screen, with your new values in place.

Selecting the “OFF” button not only sets the value to “OFF” but also saves the new value.

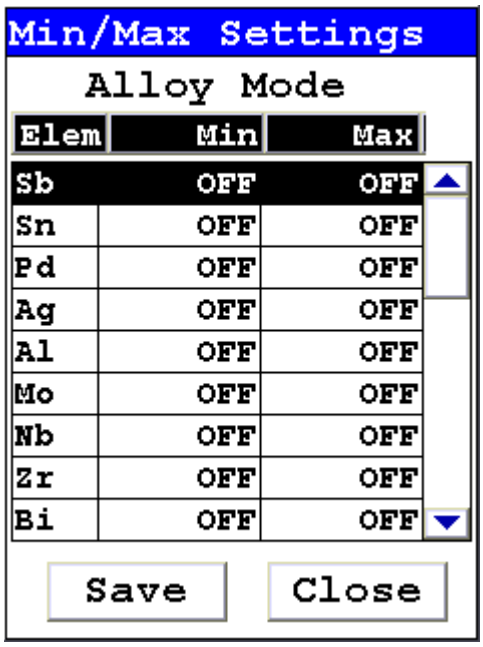


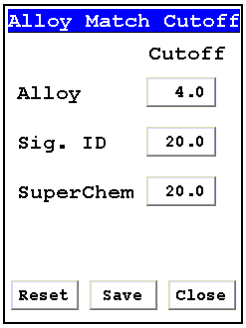
Figure 1-66. The Settings Screen with new parameters

Select the Save Button to save your current status as the new default. After saving, you will go back to the **Element Display Menu**.

Select the Close Button to exit without saving. When you select the Close Button after changing the display state of any element, a screen will open asking you if you want to save the changes you made. Selecting "Yes" will save these changes as the new default. Selecting "No" will return you to the **Element Display Menu** without saving the changes.

Figure 1-67. Save Changes Screen

The Adjust Alloy Thresholds Menu



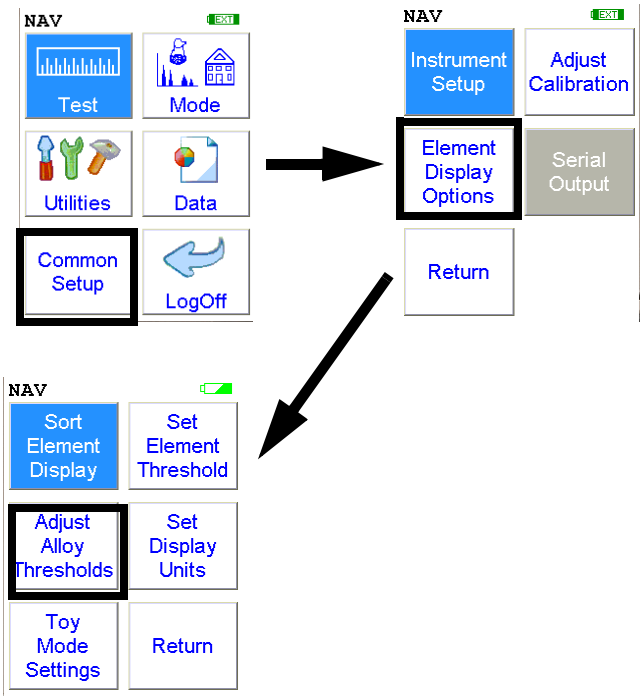


Figure 1-68. The Adjust Alloy Thresholds Menu Path

Select the **Adjust Alloy Threshold** icon to configure pass and fail criteria for alloy analysis. Selecting the **Adjust Alloy Threshold** icon opens the **Alloy Threshold Screen**.

Cutoff numbers set the allowable limits in identifications of analyzed samples. The higher the cutoff is set, the easier a match can be made in the Alloy Analysis, Signature ID, and SuperChem modes.

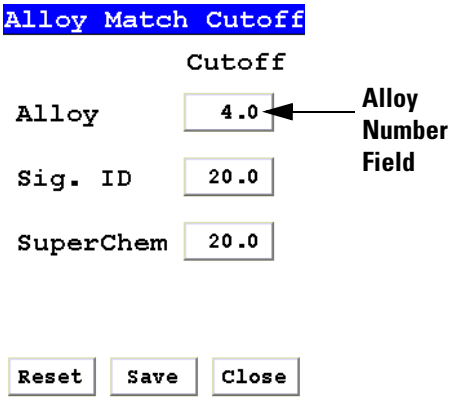


Figure 1-69. The Alloy Threshold Screen

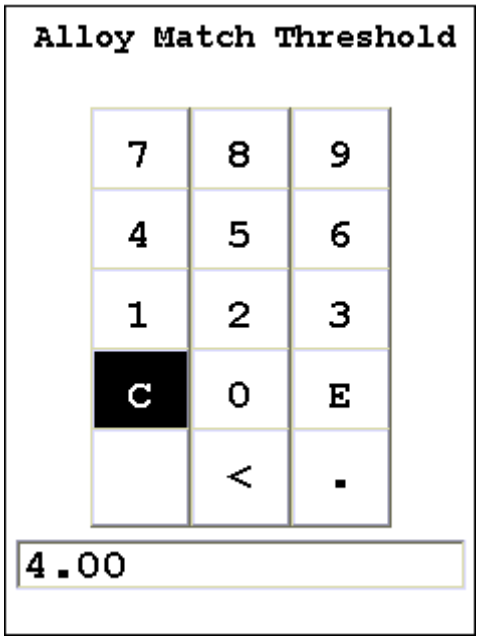
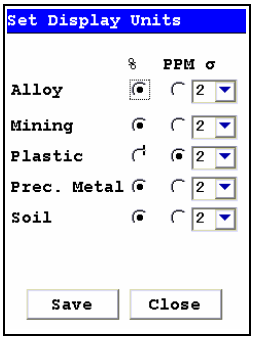


Figure 1-70. The Alloy Match Threshold Screen

The Set Display Units Menu



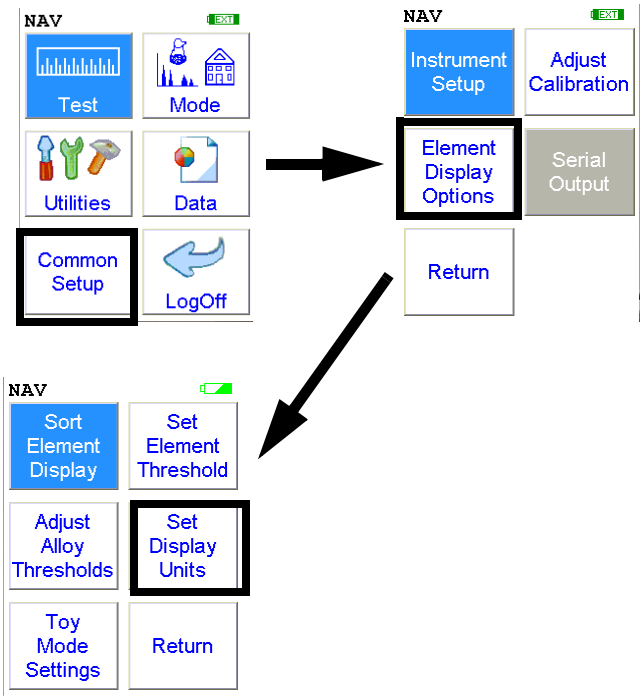


Figure 1-71. The Set Display Units Menu Path

Select the **Set Display Units** icon to choose between ppm (parts per million) and percentage (hundredths of whole) displays when taking readings, and to change the Sigma value you want for the reading. Selecting the **Set Display Units** icon opens the **Set Display Units Screen**.

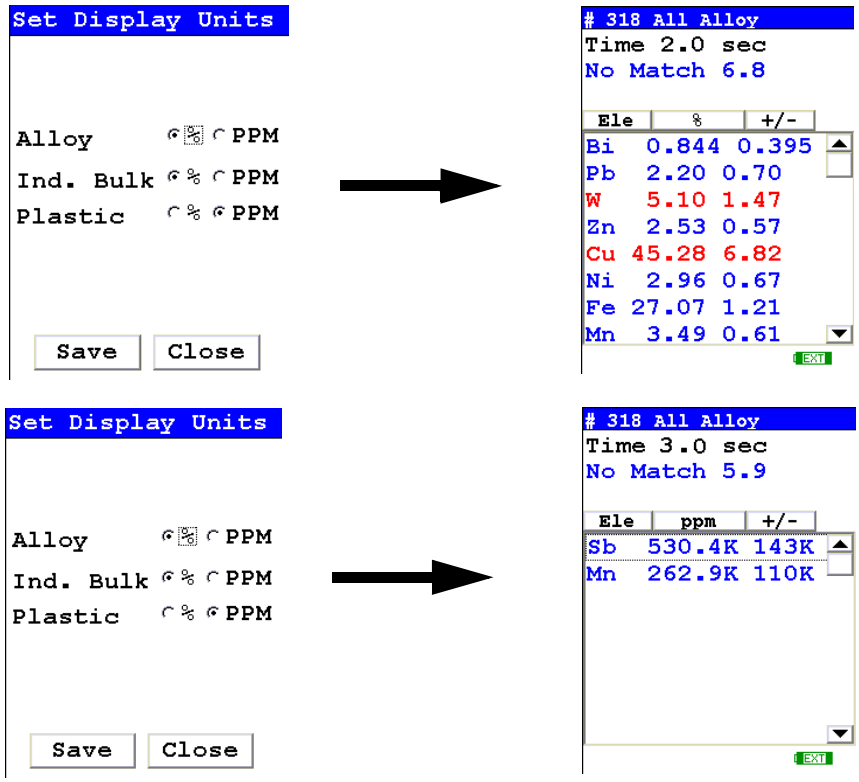


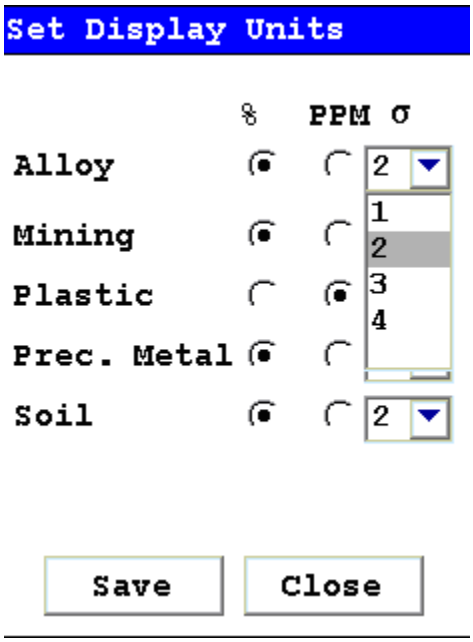
Figure 1-72. Display Units Screen and Associated Results Screens

The Display Units Screen

The **Display Units Screen** allows you to select either PPM or Percentage display on the **Results Screen** for **Alloy**, **Mining**, **Plastic, Precious Metal, or Soil Modes**. Select the radio button for the preferred display unit, then select the Save button, and subsequent results will be shown in that unit type.

Note Readings will retain the unit type used when the reading was taken, even if the units are changed. ♦

Changing Sigma



Sigma

Sigma is the symbol used for Standard Deviation, a measure of how much a set of numbers deviates from the mean. For example, each of the three data sets {0, 0, 14, and 14}, {0, 6, 8, and 14} and {6, 6, 8, 8} has a mean of 7. Their standard deviations are 7, 5, and 1, respectively. The third set has a much smaller standard deviation than the other two because its values are all close to 7. In a loose sense, the standard deviation tells us how far from the mean the data points tend to be.

The number of standard deviations between the process mean and the nearest specification limit is given in sigmas. As process standard deviation goes up, or the mean of the process moves away from the center of the tolerance, the sigma number goes down, because fewer standard deviations will then fit between the mean and the nearest specification limit.

Confidence Intervals

Confidence intervals assume that the data are from an approximately normally distributed population - generally, sums of many independent, identically distributed random variables tend towards the normal distribution as a limit. Using this assumption, about 68 % of the values must be within 1 standard deviation of the mean, about 95 % of the values must be within two standard deviations, about 99.7 % must lie within 3 standard deviations, and about 99.99% of the values must lie within 4 standard deviations.

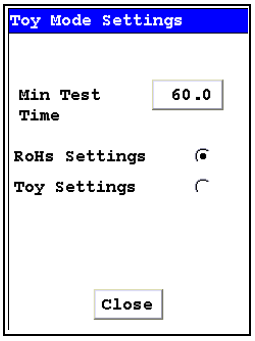
The greater the sigma value of the test, the more confident you can be that the sample is as it appears, but the more difficult and time consuming the testing must be to verify this. That's why it's important to use the most appropriate sigma value for the test. By adjusting the sigma value for each type of test, you can optimize the process for your needs.

Adjusting the Sigma Values

The sigma values are listed in the column headed " -- ". The default value is 2 sigma. You can change this value by selecting the down arrow next to the value, which opens up a drop-down menu from which you can select the desired sigma value by clicking on it.

When you have changed the sigma values to the appropriate number, select the Save button to save these settings for use. Select the Close button to return to the previous screen without saving any changes.

Toy Mode



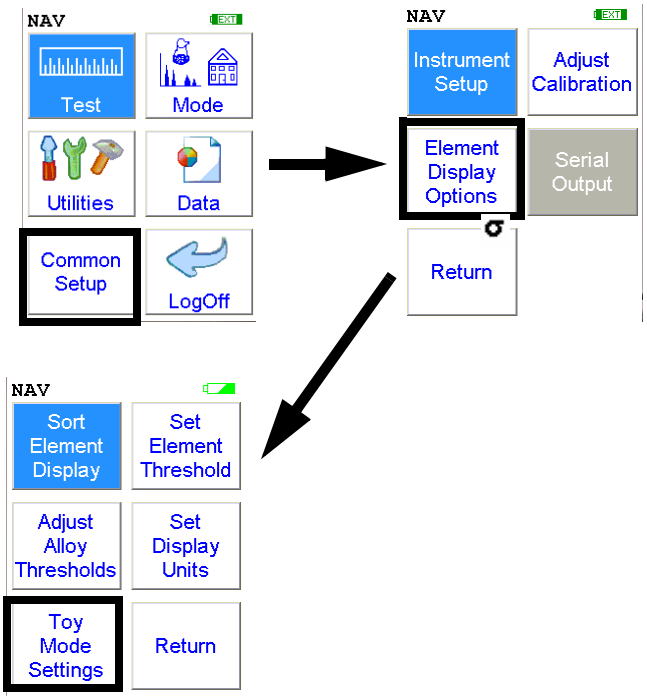
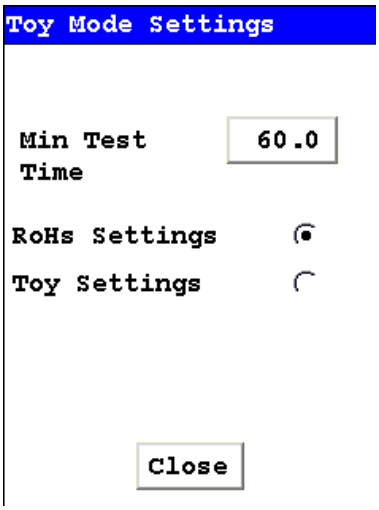


Figure 1-73. The Toy Mode Settings Menu Path

Select the **Toy Mode Settings** icon to change from RoHS Mode to Toy Mode settings. Toy Mode is an alternative plastics analysis mode which replaces the RoHS procedure with a separate Toy Mode procedure. In Toy Mode, any detected element with a PASS/FAIL setting will fail, and will not PASS any sample unless the measurement time is completed and no flagged elements are detected.

.



Chapter 2 Routine Maintenance Guidelines

Battery Pack and Battery Charger

Each NITON Analyzer is shipped with two lithium ion battery packs. When fully charged, the battery pack provides approximately 6-8-12 hours of use, depending on duty cycle.

Replacement battery packs (NITON part number 600-5640) may be ordered from NITON in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, or from your local Authorized NITON Analyzers Service Center.

Note Before beginning a test, be certain that the battery has sufficient charge. ♦

CAUTION Do not leave the battery pack connected to the charger for excessive periods of time. Overnight recharging is recommended. ♦

CAUTION Store the analyzer and the spare battery packs in a cool place, away from direct sunlight. ♦

Replacing The Battery Pack

1. **Slide back the catch on the bottom of your analyzer's pistol grip and drop the battery out into your hand.**

2. **Place the old battery aside and slide the new battery up into the cavity in the bottom of the pistol grip. The battery is keyed, and will only indert fully one way.**

3. **Slide the catch on the bottom of the battery forward to lock it in place.**

4. **Press in the battery housing latch.**

5. **Slide out the battery pack out.**

6. **Fully insert the new battery pack, making sure that it seats properly.**

7. **Press in until the latch resets.**

Figure 2-1. Location of the Battery Housing Latch

Recharging The Battery Pack

Fully recharging a battery pack takes approximately 2 hours.

1. **Remove the battery pack from the analyzer.**

2. **Place the battery pack upside down into the charger. The battery pack is keyed, and will only fit into the charger fully one way. If your battery pack is resting on the back of the back of the charger rather than sliding all hte way to the bottom, remove the battery pack, turn it around, and re-insert it into the charger.**

3. **The red light is on when the charger is plugged in. This is the power indicator light.**

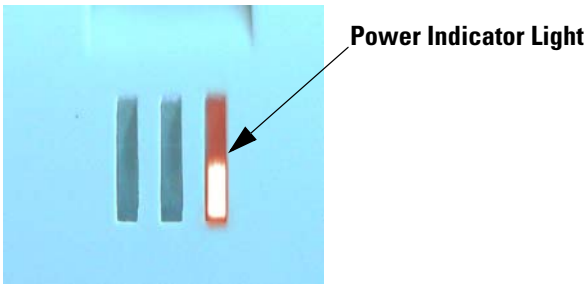


Figure 2-2. Power Indicator Light

4. **The yellow light indicates that the battery pack is currently being charged..**

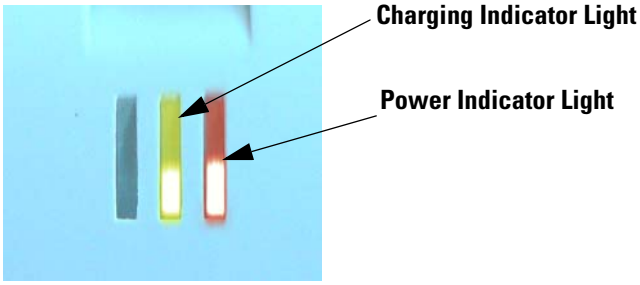
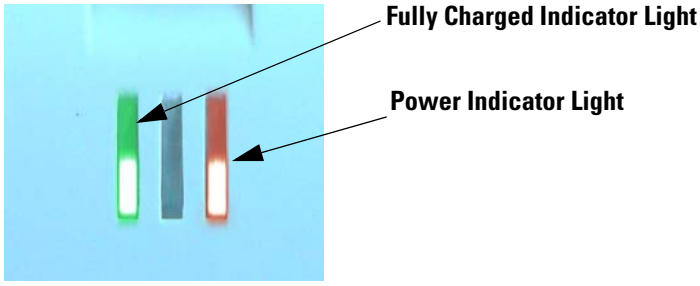


Figure 2-3. Charging Light

5. **The green light indicates that the battery pack has finished charging and is ready for use.**



6. **If there is a fully seated battery pack in the charger and only the red light is on, there is a fault with the battery pack or charger.**

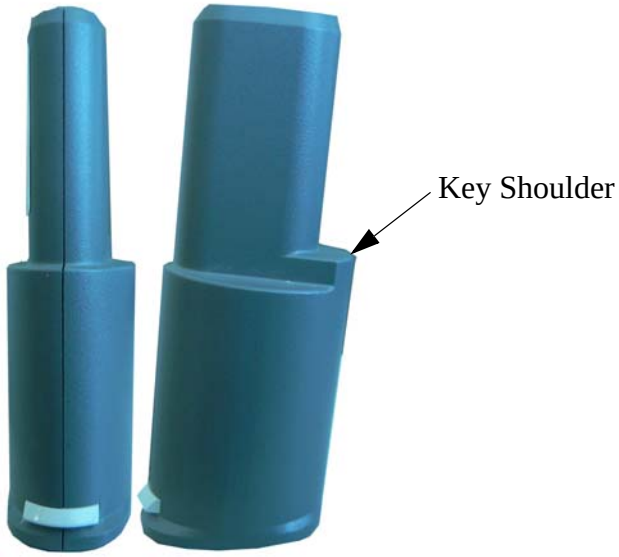


Figure 2-4. Rear and Side views of Battery Pack showing key

Figure 2-5. Battery Pack in the Charger

CAUTION Do not store battery packs or charger in direct sunlight. ♦

CAUTION Do not let the battery pack recharge for excessive periods of time. ♦

Maintenance, Cleaning and Repairs

To ensure the reliability, durability, and performance of your NITON Analyzer, keep it clean—especially the transparent Kapton window covering the analysis window. Clean the Kapton window gently with a cotton swab. Clean the body of the analyzer with a soft cloth. Never use detergents, or solvents on your analyzer, or immerse your analyzer in water. If the Kapton window becomes frayed, ripped, or contaminated with metal particulates, replace it with a new window. Kapton windows (NITON P/N 187-095) may be ordered from Thermo Fisher Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460 or from your local Authorized NITON Analyzers Service Center.

From time to time, your touch screen will need cleaning. NITON recommends that you use a lens cleaning solution with a soft cloth. Do not use water to clean your NITON Analyzer.

WARNING! All Service, except exterior cleaning and Kapton window replacement, must be performed by Thermo Scientific or an Authorized NITON Analyzers Service Center. Do not attempt to make repairs yourself. Opening the case of your NITON will void the analyzer Warranty in its entirety. ♦

CAUTION Always obtain a Return Authorization (RA) number from Thermo Fisher Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460 before returning your analyzer to the NITON Service Department or local Authorized NITON Analyzers Service Center. ♦

Replacing the Kapton Window

1. **Remove the two Phillips head screws.**

Figure 2-6. View of Face Plate and Kapton Window

2. **Remove the face plate and place it face down.**

Figure 2-7. Face Plate Removed showing Kapton Window on Reverse

3. **Remove the old Kapton window.**

4. **Clean the back surface of the face plate and install the new Window.**

5. **Turn the face plate over and replace it on the analyzer's front end, fitting the plate carefully over the Proximity Button.**

Figure 2-8. Fitting Face Plate over Proximity Button

6. **Reinstall the two screws, being careful not to over-tighten them.**

Figure 2-9. Replacing the Screws.

Storing and Transporting Your XL3 Analyzer

All NITON Analyzers are transported in waterproof, drop-resistant, fully padded carrying cases with padlocks. In most countries, NITON XRF analyzers may be transported by car or plane or shipped as an *ordinary* package. For most courier services, no special labels are required on the outside of the NITON analyzer case or on additional packaging.

Figure 2-10. The NITON Carrying Case

All padlocks are shipped with a default combination of "0-0-0". If you change this combination, please inform Thermo of the new combination if you return the unit for service.

To change the combination:

1. **Dial the default combination to open the lock, and pull out the shackle.**

2. **Rotate the shackle 180 degrees and push it down as far as it can go.**

3. **While holding the shackle down, rotate it 90 degrees back in either direction and release shackle.**

4. **Change the dial settings to the desired combination, record the combination, and without disturbing the dials, rotate the shackle back 90 degrees to the position it had in step 2.**

5. **Pull shackle out and rotate it 180 degrees and secure it. Your lock now has its own secret combination.**

CAUTION Always transport the unit in its padded carrying case, and store the NITON Analyzer in its case whenever it is not being used. ♦

CAUTION In most cases, no notification is required if transporting within state boundaries. This may not be the case when entering federal properties. ♦

CAUTION Within the United States, always keep a copy of the US DOT compliance statement in your NITON analyzer case at all times. A copy is included with your analyzer. ♦

CAUTION Always follow all pertinent local and national regulations and guidelines, wherever your analyzer is transported or used. ♦

CAUTION Always obtain a Return Authorization (RA) number from Thermo Fisher Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460 before returning your analyzer to the Service Department or to your local Authorized NITON Analyzers Service Center. ♦

CAUTION If you return your NITON analyzer without the carrying case, you will void your warranty in its entirety. You will be billed for a replacement case plus any repairs resulting from improper shipping. ♦

CAUTION Always remove the battery pack when transporting or storing your analyzer. ♦

Networking and Connectivity

Setting up Wireless Networking

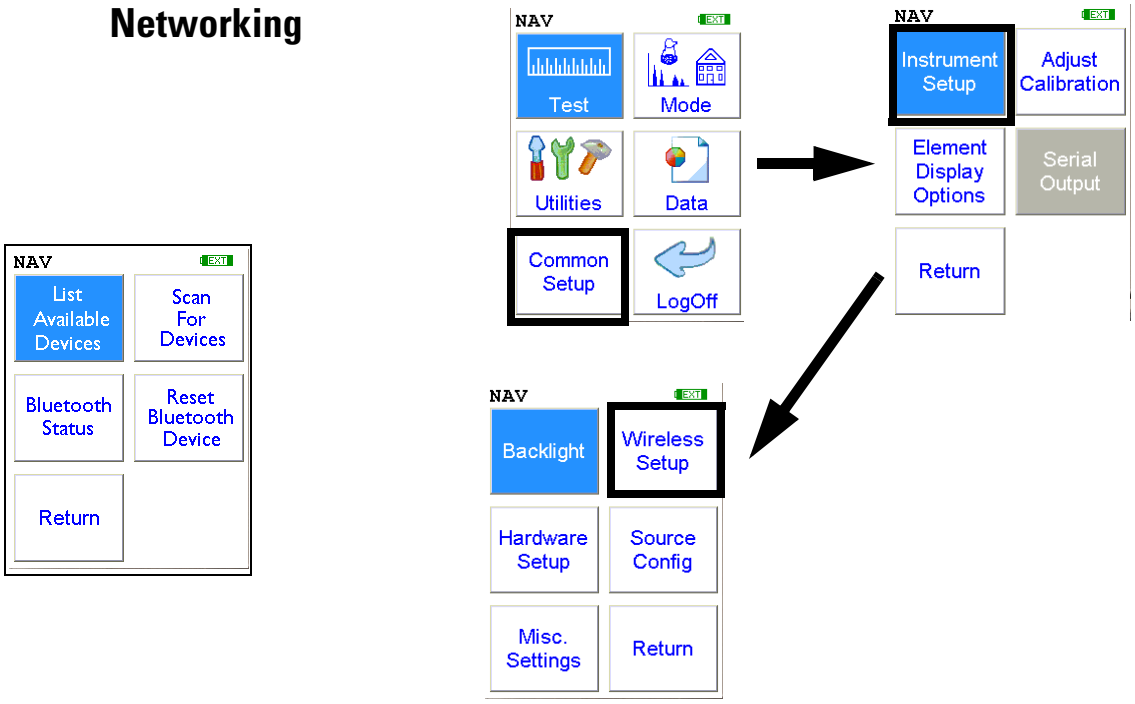
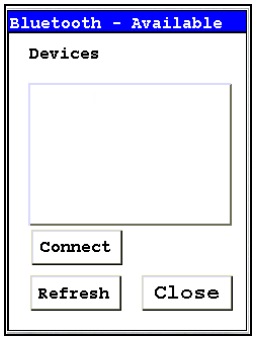
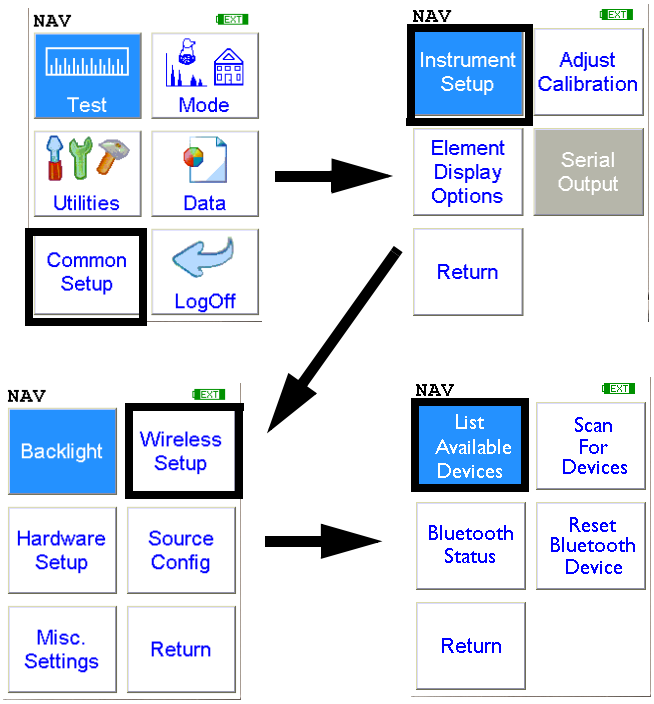


Figure 2-11. Wireless Networking Menu Path

Bluetooth Wireless Networking enables you to connect to your computer and other Bluetooth-enabled devices such as printers and GPS devices without the need of cabling, ports, or hubs.

Available Devices Screen





Select the List Available Devices icon to show a list of Bluetooth devices previously discovered. The Bluetooth devices listed are only those which were present at the last time you ran a discovery scan for Bluetooth devices, as the list is not automatically updated. Selecting the List Available Devices icon brings up the Available Devices screen. From the list, you can connect your analyzer to those devices.

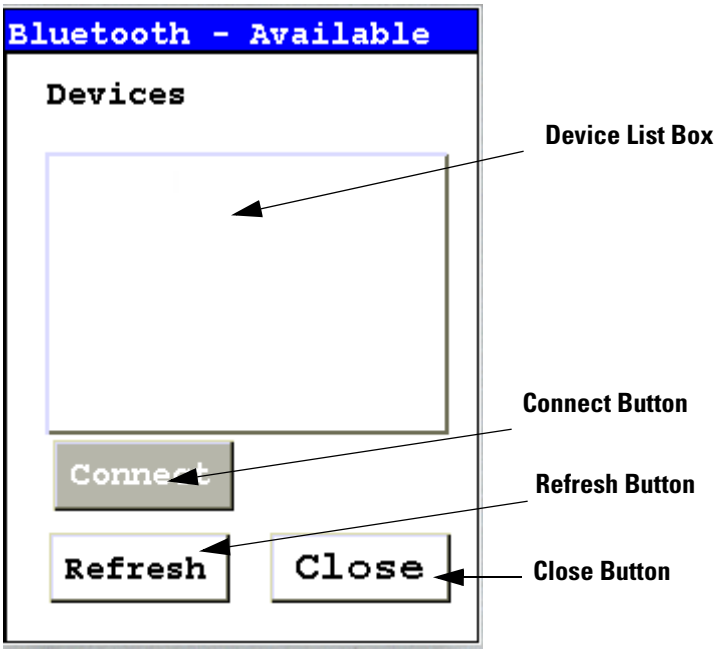


Figure 2-12. Available Devices Screen

Under "Devices," in the Device List Box, the Available Devices Screen lists all known applicable Bluetooth devices in the area found during the last refresh or scan.

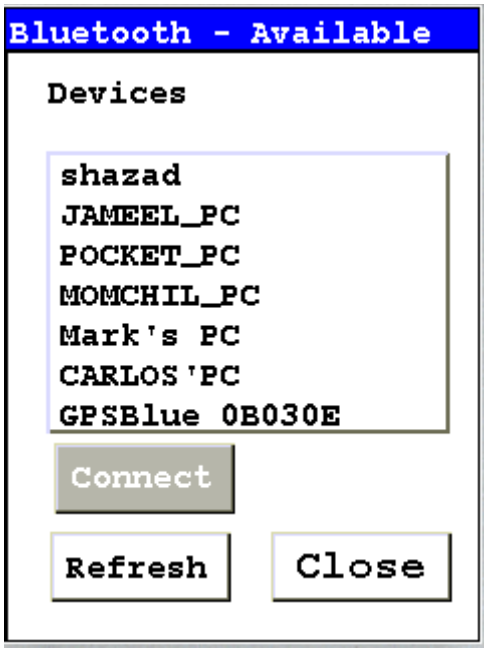


Figure 2-13. Example Device List

- Selecting the Refresh Button initiates a scan of the area for new Bluetooth devices. Devices no longer present are removed.

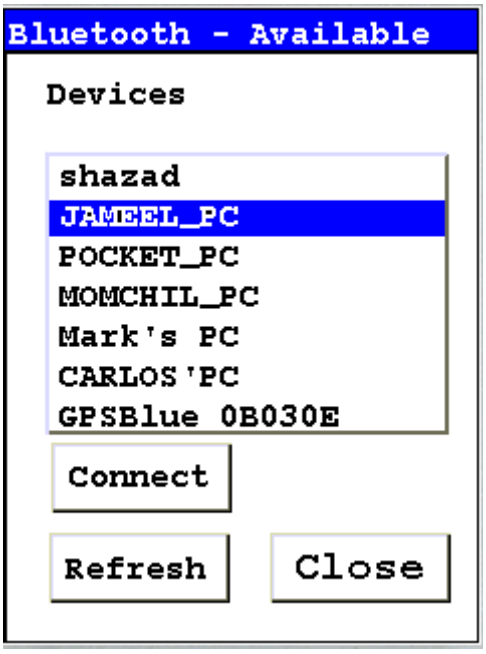
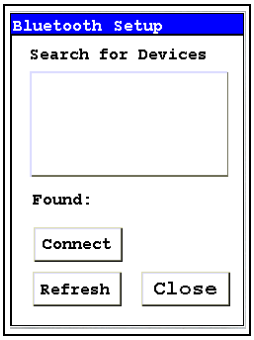
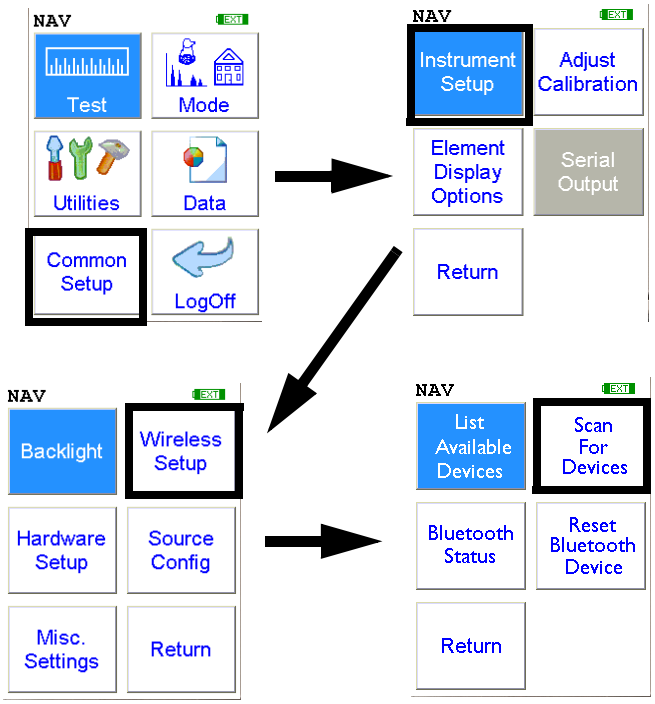


Figure 2-14. Available Device Refresh

- Selecting a listed Bluetooth Device enables the Connect Button.
- Selecting the Connect Button will connect your analyzer to the selected device. See the Connected Screen.

Bluetooth Search Screen





Select the Scan For Devices icon bring up the Bluetooth Search Screen, enabling you to initiate a discovery scan of Bluetooth devices in the operational area. This scan will find all appropriate Bluetooth devices in the operational area, enabling you to connect to those devices.

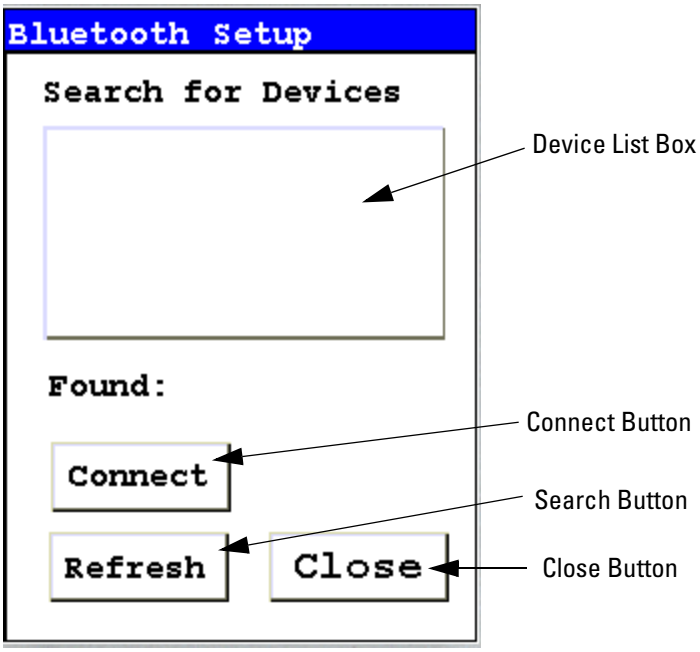


Figure 2-15. Bluetooth Search Screen

The Bluetooth Search Screen does not retain information about previously detected Bluetooth Devices. Each time the Bluetooth Search Screen is opened, the Device List Box is empty.

- Selecting the Search Button initiates a scan for Bluetooth Devices in the area.

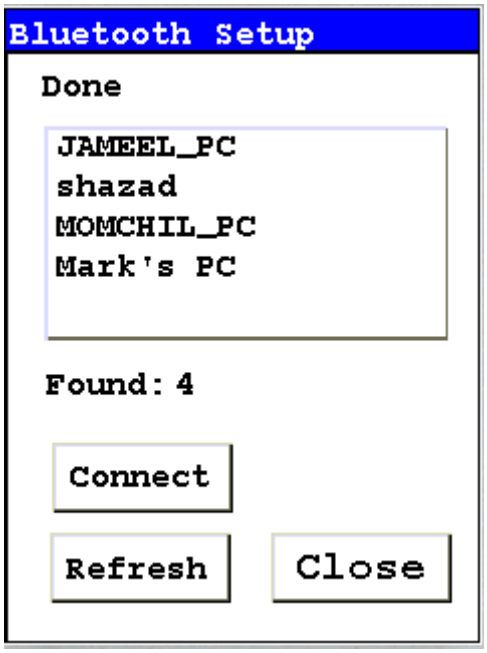


Figure 2-16. Example Search List

Depending on where and when the Search Scan is conducted, certain devices may or may not be detected. You can select a device and connect to that device in exactly the same manner as in the Available Devices Screen, once the search is finished.

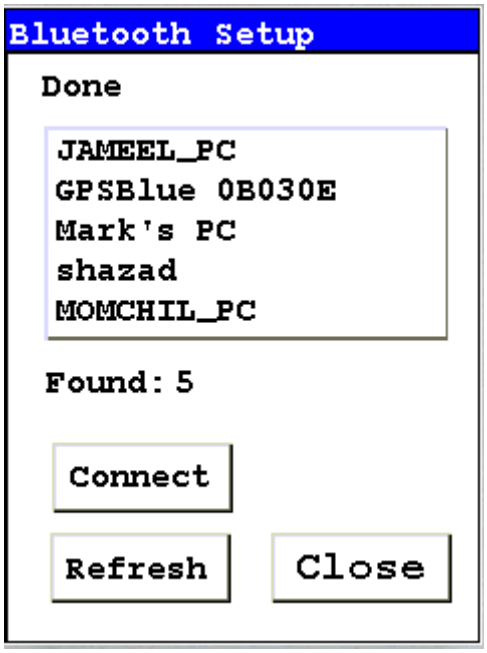


Figure 2-17. Search List with New Device Found

The Connected Screen

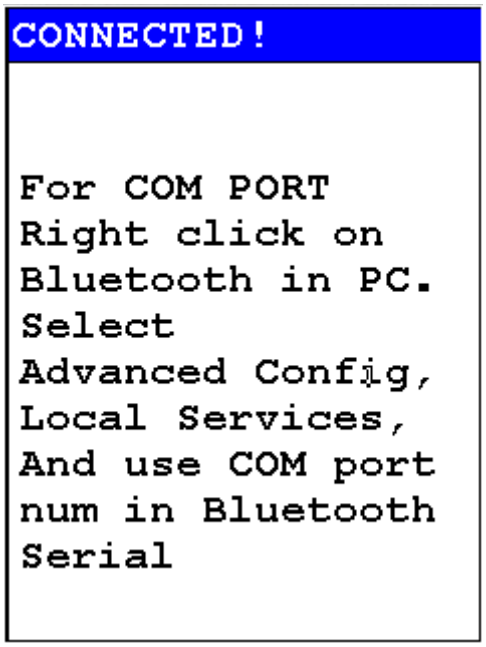


Figure 2-18. The Connected Screen

When you have connected your analyzer to a Bluetooth Device, you get the Connection Screen. The Connection Screen serves as a reminder of what needs to be done to use the connection. With simple devices like GPS devices, a notification that you are connected is given, and everything just works, but working with a PC is a bit more complex.

In order to use a Bluetooth Serial Connection with a PC, you need to know which COM port Bluetooth is connected through. To determine this, right click on the Bluetooth logo in your system tray on your PC. From the popup menu which appears, select Advanced Config., then select Local Services.

Figure 2-19. Advanced Configuration selection on PC

Service Name	Startup	Secure Connection	COM Port
Audio Gateway	Auto...	Not Required	
Headset	Auto...	Not Required	
PIM Synchronization	Manu...	Required	
Fax	Manu...	Required	
File Transfer	Auto...	Required	
PIM Item Transfer	Manu...	Not Required	
Dial-up Networking	Manu...	Required	
Network Access	Auto...	Required	
Bluetooth Serial Port	Auto...	Not Required	COM3

Figure 2-20. Bluetooth Service Listing on PC

In the Bluetooth Serial Port row, the COM port used by Bluetooth is identified. Use this port for any interactions between your analyzer and your computer, such as NDT or NDTr.

Make sure that the Secure Connection setting for the Bluetooth Serial Port is set to "Not Required."

Service Name	Startup	Secure Connection	COM Port
Audio Gateway	Auto...	Not Required	
Headset	Auto...	Not Required	
PIM Synchronization	Manu...	Required	
Fax	Manu...	Required	
File Transfer	Auto...	Required	
PIM Item Transfer	Manu...	Not Required	
Dial-up Networking	Manu...	Required	
Network Access	Auto...	Required	
Bluetooth Serial Port	Auto...	Not Required	COM3

Figure 2-21. Selecting Bluetooth Serial Port on PC

To edit the setting, double click the row.'

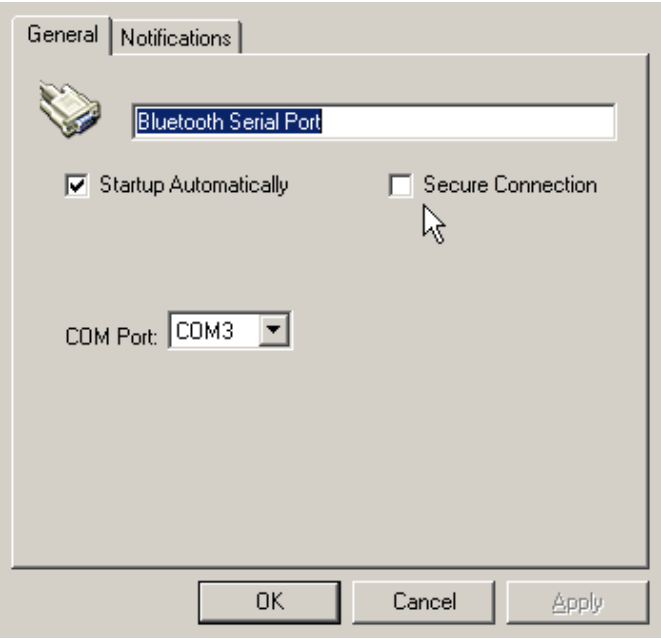
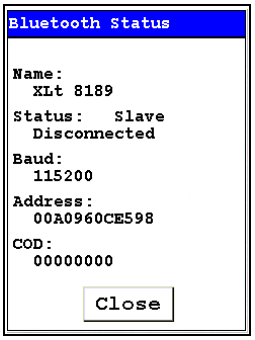
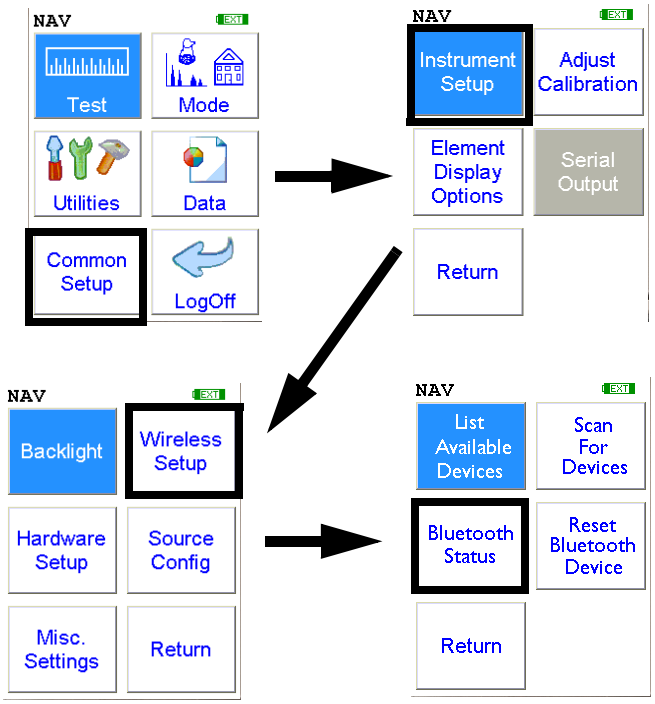


Figure 2-22. Changing the Bluetooth Secure Connection Checkbox on PC

Unselect the Secure Connections checkbox if it is already selected, then select the “OK” button.

Bluetooth Status Screen





The Bluetooth Status Screen enables you to see at a glance if and how your analyzer is connected to your computer.

Figure 2-23. Example Bluetooth Status Screen

Select the Bluetooth Status icon to view the current status of your Bluetooth connections on the Bluetooth Status Screen. The Bluetooth Status Screen will display your analyzer's serial number, connection status, the transfer rate, and your analyzer's address

The Bluetooth Status Screen shows your analyzer's identification label, its connection state, the speed of the communication port setting, your analyzer's network address, and the COD.

In Figure 2-23, the analyzer "XL3t 20" is not connected to any computer, was last in Slave state - i.e. the last connection was initiated by the computer and not by the analyzer, has a com port set to communicate at 115200 baud, has the unique network (MAC) address of 00A0960CE598, and has a COD (Class Of Device) of 00000000.

The Close screen button will return you to the Wireless Setup Menu.

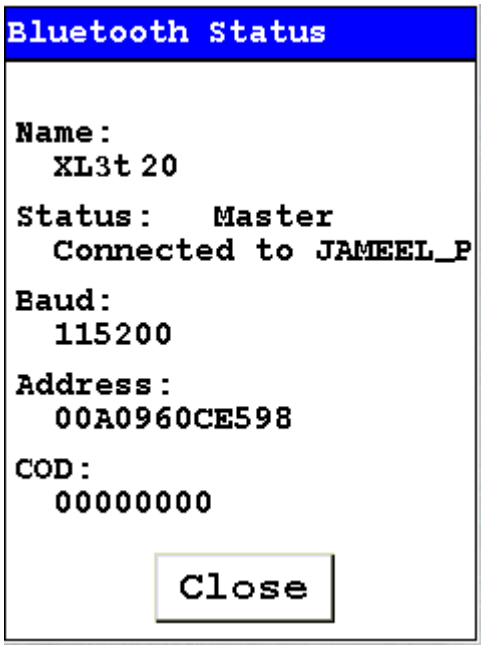
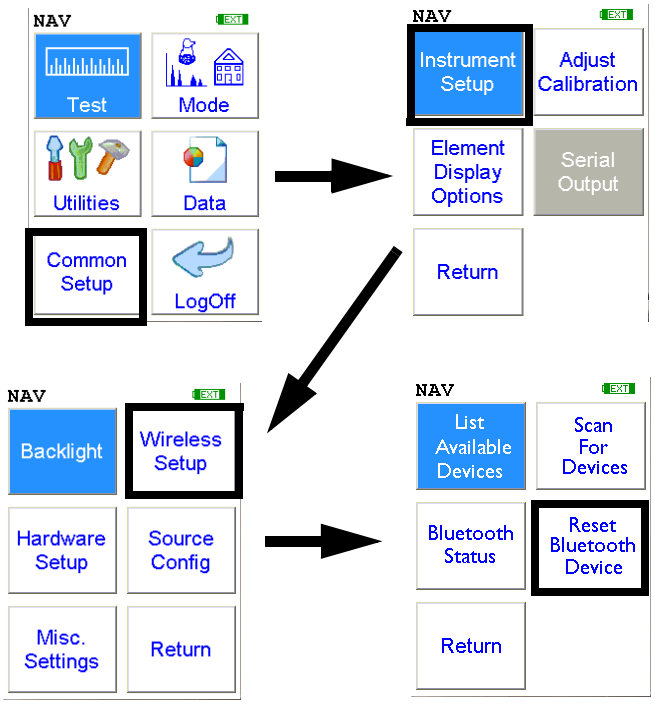


Figure 2-24. Second Example Bluetooth Status Screen

In another example, in Figure 2-24, the analyzer "XL3t 20" is connected to the computer JAMEEL_P, is currently in Master state - i.e. connection was initiated by the analyzer and not by the computer, has a com port set to communicate at 115200 baud, has the unique network (MAC) address of 00A0960CE598, and has a COD (Class Of Device) of 00000000.

Reset Bluetooth Device



Select the **Reset Bluetooth Device** icon to initiate an immediate reset of the Bluetooth Wireless Networking. Selecting the **Reset Bluetooth Device** icon will clear out old settings and data, as well as enabling you to switch between Bluetooth and standard serial cable. While resetting, your analyzer will show the following screen:

Figure 2-25. Bluetooth Reset Alert

GPS Data Tracking

Bluetooth equipped NITON XRF Analyzers are capable of communicating with GPS modules and saving GPS coordinates with every reading. Follow the Bluetooth connection instructions found in the Users Manual to scan for and connect to a Bluetooth enabled GPS device.

Once connected, the GPS unit sends out a number of signals that can be read. The analyzer will display the relevant information from the GPS after connection, as shown in Figure 2-26

As shown in Figure 2-27, these coordinates can be viewed in the Data screen in entry positions eight, nine, and ten. (Scroll down to reach these fields.) When the results are downloaded using the NDT software the GPS coordinates are also stored and downloaded in data entry fields eight, nine and ten.

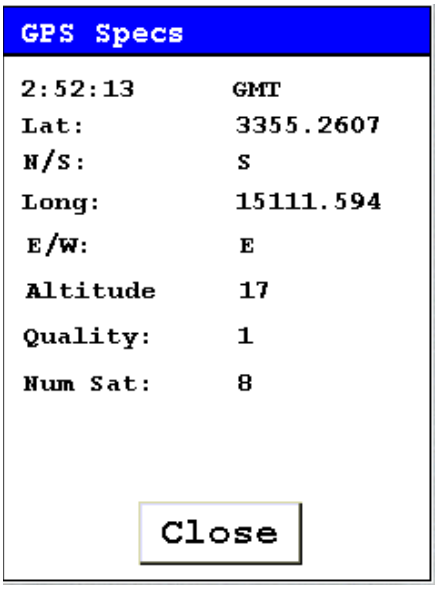


Figure 2-26. Example of GPS Data

Example of GPS Data

- 2:52:13 GMT - Greenwich Mean Time obtained from the GPS satellites.
- Lat: 3355.2607 -Latitude coordinate of current location. This should be read as:
  - All digits to the right of the decimal point are seconds.
  - First two digits to the left of the decimal point are minutes.

- The next two or three digits to the left of the decimal point are degrees.
- Thus 3355.2607 is read 33 degrees 55 minutes 26.07 seconds.

- N/S: S - Compass direction of Latitude.
- Long: 15111.594 - Longitude coordinate of current location.
  - All digits to the right of the decimal point are seconds.
  - First two digits to the left of the decimal point are minutes.
  - The next two or three digits to the left of the decimal point are degrees.
  - Thus 15111.594 is read 151 degrees 11 minutes 59.4 seconds.
- W/E: E - Compass direction of Longitude.
- Altitude: 17 - Height above sea level in meters.
- Quality: 1 - Quality of signal strength.
- Num Sat: 8 - Number of satellites signals being received by GPS. This number varies depending on your position, the current position of the satellites, and the signal strength.

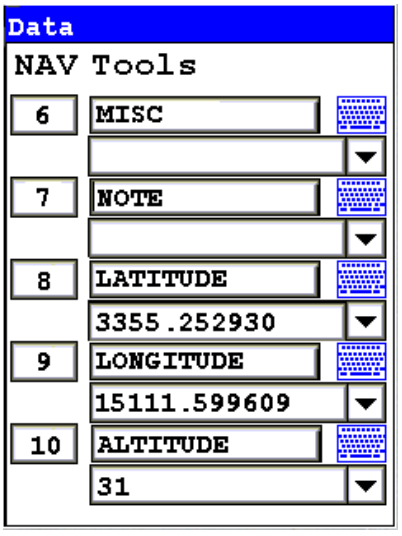


Figure 2-27. GPS Data Integrated Into Reading Data

GPS Options

The communication system standard required for compatibility is NMEA0182 ver. 3.0, using GPGGA, GPSA, GPRMC, and GPSV formats. This type of GPS is most commonly used for motor and marine directional mapping systems.

Tested Units include:

Copilot BTGPS3

http://www.alk.com/copilot/pocketpc.asp

RoyalTek Star111

http://www.royaltek.com/index.php/content/view/98/80/

IOGEAR Bluetooth GPS

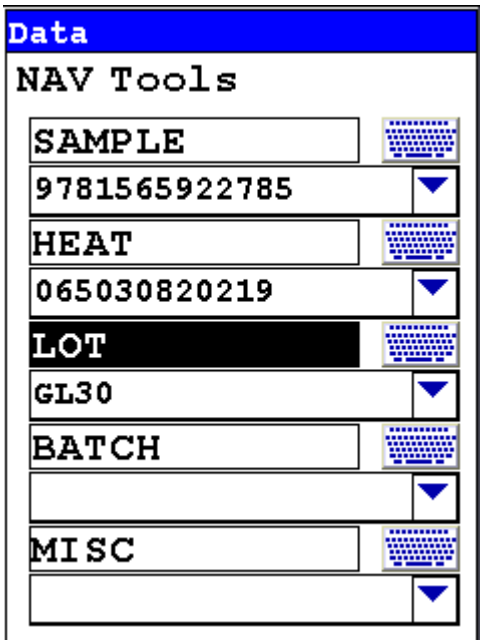
http://www.iogear.com/main.php?loc=product&Item=GBGPS201W6

Note These GPS systems have an accuracy of about 10 meters.

Entering Data with a Barcode reader

You can also use Bluetooth barcode readers with your analyzer. Connect your reader to your analyzer in the usual way, see See Chapter 2 page 11 for details. Once the reader is connected, you can use it to input data into your analyzer.

- On the data entry screen, highlight the desired field.
- While pressing the button on the Barcode Pencil, swipe the desired barcode. If the pencil successfully reads the barcode, it will beep.
- The barcoded data will show up in the data field after the beep. There is a short delay while the information is being transmitted
- You may also use the Virtual Keyboard Screen to enter barcoded data.



You can replace, append or clear any field with a custom barcode:

- R05TEXT replaces field 5 with the TEXT
- A05C – appends field 5 with the letter C
- C05 – clears field 5
- C00 – clears all fields

Supported Barcode Readers

At the time of publication, supported readers include:

- The Baracoda Barcode Pencil

The Baracoda Barcode Pencil supports these barcodes for use with the XL3 system.

- Code 96
- Code 128/EAN 128
- EAN13/UPCA
- UPCE/EAN8
- Code 39
- Codabar
- Interleaved 2 of 5
- Standard 2 of 5
- Code 11
- MSI RSS14
- RS Limited

Consult your Baracoda Pencil Users Manual for more information and information on successful barcoding.

Setting Up and Using the USB port

The USB port is the narrow inverted trapezoidal port on the back of your XL3 Analyzer. You can use this port, along with the supplied cable, to communicate with your analyzer.

Figure 2-28. Location of Mini-USB port

Insert the smaller end of your USB cable into the Mini-USB port on the back of your XL3, and the larger end into any USB port on your computer.

When you turn your analyzer on after it is connected, or if you connect it while the analyzer is on, a "Found New Hardware" Wizard will open, as in Figure 2-29.

Figure 2-29. Found New Hardware Wizard

Note If, after installation, you plug your USB cable into a different USB port on your computer, you will get this Wizard again.

The Installation Wizard

Place the installation CD in the drive, select "No, not this time" then select "Next." The Wizard will now ask you what you want it to do, as in Figure 2-30. Select "Install the software automatically."

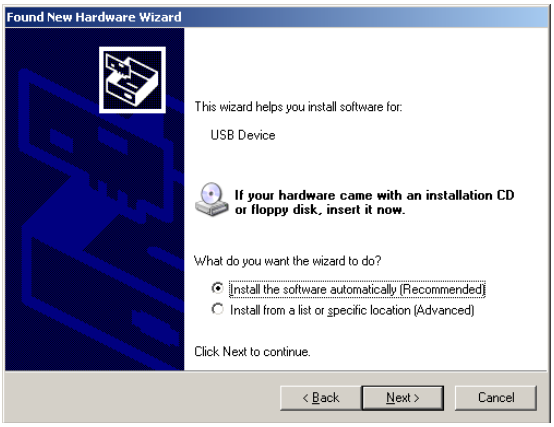


Figure 2-30. Wizard Choice

The Wizard will now search the CD for the proper software, as in Figure 2-31. When the Hardware Installation window comes up stating that the software has not passed XP logo certification, don't worry. The driver is from Microsoft. Select "Continue Anyway."

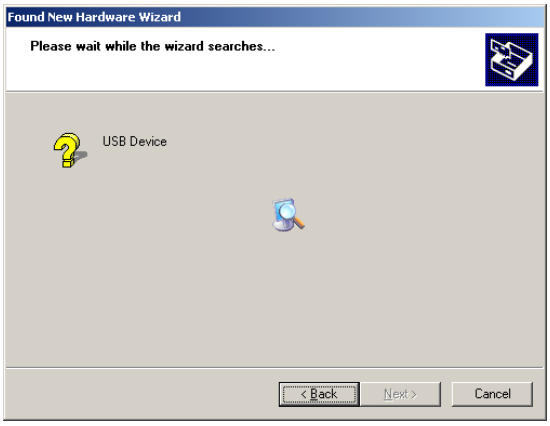


Figure 2-31. Installation Wizard Search

The Wizard will now install the software. This may take several minutes. At the end of this process, you will see the final Wizard screen, as in Figure 2-32, informing you the process is complete. Select "Finish."

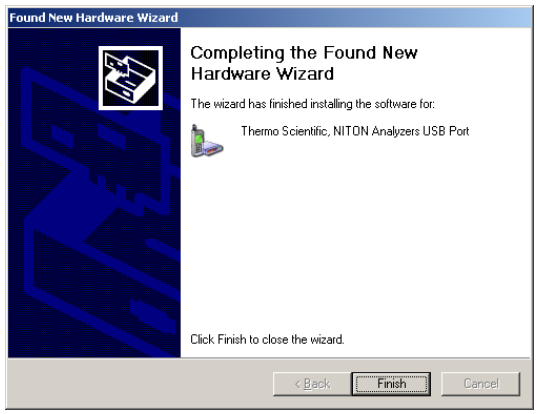


Figure 2-32. Final Installation Wizard Screen

The driver will install as the next free COM device - for example, if you have devices installed as COM1 through COM 5, the driver will install as COM 6. You can find how the software has been installed by clicking your START button, selecting Settings, and selecting Control Panel - as in Figure 2-33.

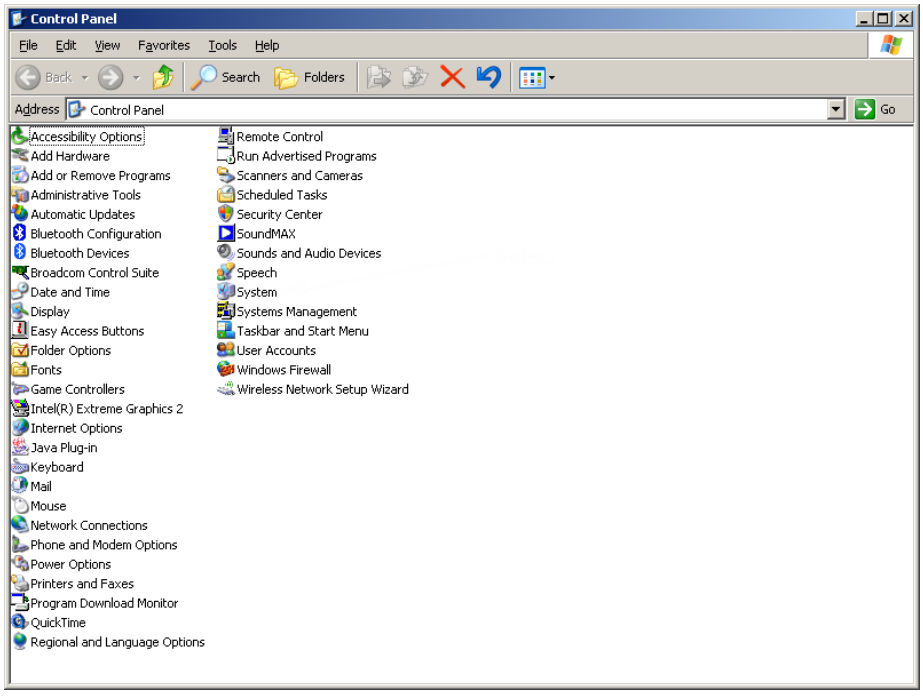


Figure 2-33. The Control Panel

From the Control Panel, double click on System. The System control panel will appear. "Select the "Hardware" tab. The window will appear as in Figure 2-34. Select "Device Manager."

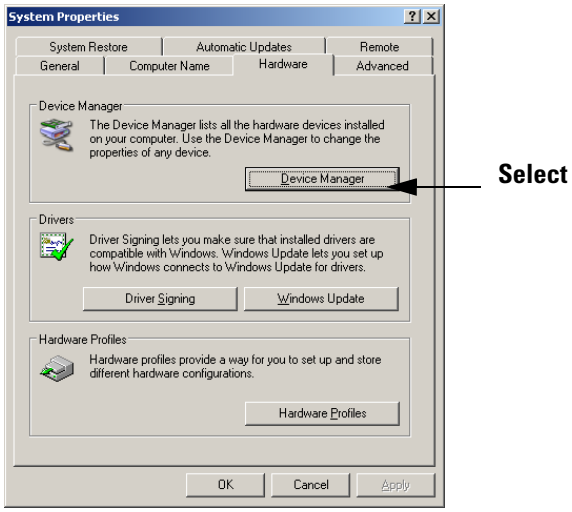


Figure 2-34. The Hardware Screen

The device will appear under "Ports" in the Device Manager - select the plus sign in the box to display all the assigned ports. The device will be called "Thermo Scientific, NITON Analyzers USB Port." After the name, the port number will be displayed in parentheses - in Figure 2-35, the device is assigned to COM 6. Use this port to connect to your analyzer.

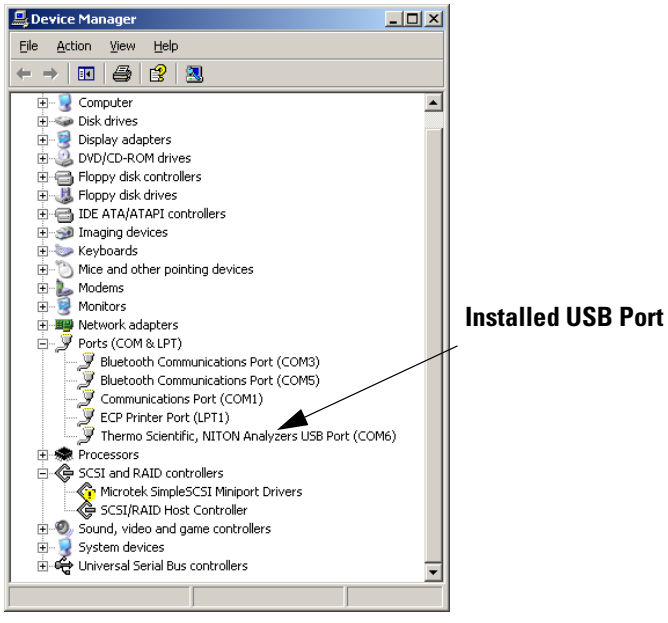


Figure 2-35. The Device Manager

Chapter 3 Radiation and General Safety

This chapter covers topics related to radiation safety and general safety when using a Thermo Scientific NITON XL3t analyzer. At a minimum all operators of the XL3t should be familiar with the instructions provided in this chapter in order to handle the XL3t in a safe manner. In addition to reading the information presented on the following pages, Thermo Fisher Scientific recommends that instrument users participate in a radiation safety and operational training class.

WARNING! Always treat radiation with respect. Do not hold your analyzer near the Kapton window during testing. Never point your analyzer at yourself or anyone else when the shutter is open. ♦

Radiation and General Safety

This chapter covers topics related to radiation safety and general safety when using a Thermo Scientific NITON XL3t analyzer. At a minimum all operators of the XL3t should be familiar with the instructions provided in this chapter in order to handle the XL3t in a safe manner. In addition to reading the information presented on the following pages, Thermo Fisher Scientific recommends that instrument users participate in a radiation safety and operational training class.

Radiation Protection Basics

The NITON Model XL3t analyzer contains an x-ray tube which emits radiation only when the user turns the x-ray tube on. When the x-ray tube is on and the shutter is open, as during a measurement, the analyzer emits a directed radiation beam (See Figures 0-6 and 0-7). Reasonable effort should be made to maintain exposures to radiation as far below dose limits as is practical. This is known as the ALARA (As Low as Reasonably Achievable) principle. For any given source of radiation, three factors will help minimize your radiation exposure: Time, Distance, and Shielding.

Time

The longer you are exposed to a source of radiation the longer the radiation is able to interact in your body and the greater the dose you receive. Dose increases in direct proportion to length of exposure.

Distance

The closer you are to a source of radiation, the more radiation strikes you. Based on geometry alone, dose increases and decreases with an inverse-squared relation to your distance from the source of radiation (additional dose rate reduction comes from air attenuation). For example, the radiation dose one foot from a source is nine times greater than the dose three feet from the source. Remember to keep your hands and all body parts away from the front end of the analyzer when the shutter is open to minimize your exposure.

Shielding

Shielding is any material that is placed between you and the radiation source. The more material between you and the source, or the denser the material, the less you will be exposed to that radiation. Supplied or optional test stands are an additional source of shielding for analysis. A backscatter shield accessory is also available and may be appropriate in some applications.

Exposure to Radiation

Human dose to radiation is typically measured in rem, or in one-thousandths of a rem, called millirem (mrem), 1 rem = 1000 mrem. Another unit of dose is the Sievert (Sv), 1 Sv = 100 rem. The allowable limit for occupational exposure in the U.S (and many countries internationally) is 5,000 mrem/year (50 mSv/year) for deep (penetrating) dose and 50,000 mrem/year (500 mSv/year) for shallow (i.e., skin) dose or dose to extremities. Deep, shallow, and extremity exposure from a properly used NITON XL3t analyzer should be less than 200 mrem per year, (2.0 mSv per year) even if the analyzer is used as much as 2,000 hours per year, with the shutter open continuously. The only anticipated exceptions to the 200 mrem maximum annual dose are: 1) routine and frequent analysis of plastic samples without use of a test stand, backscatter shield, or similar additional protective measures, or 2) improper use where a part of the body is in the primary beam path. NEVER OPERATE THE DEVICE WITH A PART OF YOUR BODY IN THE PRIMARY BEAM PATH OR WITH THE PRIMARY BEAM PATH DIRECTED AT ANYONE ELSE. Also, consider the use of protective accessories such as a shielded test stand or backscatter shield (or equivalent) when performing routine and/or frequent analysis of any of the following:

- plastic (or similarly low density) samples,
- thin samples (such as foils, circuit boards, and wires), or
- samples that are smaller than the analysis window.

Shown in Table 3-1 below are the typical background radiation doses received by the average member of the public. The radiation dose limits for radiation workers in the US are also shown in Table 3-2.

Table 3-1. Typical Radiation Doses Received (Source: NCRP 1987)

Category	Dose in mrem	Dose in mSv
Average total dose in US (annual)	360	3.6
Average worker exposure (annual)	210	2.1
Average exposure for an underground miner	400	4.0
Exposure for airline crew (1,000 hours at 35,000 ft)	500	5.0
Additional from living in Denver at 5300' (annual)	25	.25
Additional from 4 pCi/l radon in home	1,000	10.0
Typical Chest X-Ray	6	0.06
Typical Head or Neck X-Ray	20	0.2
Typical pelvis/hip x-ray	65	0.65
Typical lumbar spine x-ray	30	0.3
Typical Upper G.I. x-ray	245	2.45
Typical Barium enema x-ray	405	4.05
Typical CAT scan	110	1.10

Table 3-2. Annual Occupational Dose Limits for Radiation Workers (Source: Code of Federal regulations Title 10, Part 20)

Category	Dose in mrem	Dose in mSv
Whole Body	5000	50
Pregnant Worker (during gestation period)	500	5
Eye Dose Equivalent	15,000	150
Shallow dose equivalent to the skin or any extremity or organ	50,000	500
Maximum allowable dose for the general public (annual)	100	1.0
For a Minor	500	5.0

Monitoring your radiation exposure

Individuals can be monitored for the radiation dose they receive by use of radiation dosimetry devices (dosimeters). Monitoring dose using a dosimeter can be a way of identifying improper use and at the same time demonstrating proper use. In some locations, dosimetry is required by regulations and in others it is optional. It is normally required when the user could reasonably be expected to receive in excess of 10% of the annual dose limit. Thermo Fisher Scientific recommends that you determine and obey the local regulatory requirements concerning radiation monitoring of occupational workers.

Two common types of dosimeters are whole-body badges and ring badges. Whole body badges are often attached to the user's torso (e.g., clipped to the collar, shirt pocket, or waist as appropriate). A ring badge is worn on the finger as a measure of maximum extremity dose. When worn, the specific location of the dosimeter should be that part of the body that is expected to receive the highest dose. This location will depend on how the analyzer is used and so it may not be the same for all users. Dosimetry services are offered by many companies. Two companies offering dosimetry services in the USA and much of the world are:

Global Dosimetry Solutions

2652 McGaw Avenue

Irvine, CA 92614

www.dosimetry.com

(800) 251-3331

Landauer, Inc.

2 Science Road

Glenwood, IL 60425-9979

www.landauerinc.com

(800) 323-8830

Note Wearing a dosimeter badge does not protect you against radiation exposure. A dosimeter badge only measures your exposure (at the dosimeter location). ♦

Pregnancy and Radiation Exposure

International guidance documents (e.g., ICRP Publication 60 and NCRP Publication 116*) recommend that the radiation dose to the embryo/fetus of a pregnant woman should not exceed a total of 500 mrem (10% of normal radiation worker limit) during the gestation period. While this dose limit exceeds the dose limit to a trained operator, pregnant workers may want to take special precautions to reduce their exposure to radiation. For more information see the U.S. NRC Regulatory Guide 8.13 "Instruction Concerning Prenatal Radiation Exposure" which can be found on the resource CD.

* The International Commission on Radiological Protection, ICRP, is an independent Registered Charity, established to advance for the public benefit the science of radiological protection, in particular by providing recommendations and guidance on all aspects of protection against ionizing radiation.

* The National Council on Radiation Protection and Measurements (NCRP) was chartered by the U.S. Congress in 1964 as the National Council on Radiation Protection and Measurements.

How to Use the NITON XL3t Analyzer Safely

The NITON XL3t analyzer is designed to be safe to operate provided that it is used in accordance with manufacturers' instructions. Under conditions of normal use, monitored operators seldom receive a measurable dose and have not been known to receive in excess of 10% of the annual occupational dose limits (a criteria that would require monitoring under regulation in the U.S.). In addition to proper use of the XL3t, it is recommended that you follow these precautions to ensure your safety and the safety of those around you.

Know where the beam is

The primary beam is a directed beam out of the front of the analyzer that can have high dose rates. The secondary beam, or scattered beam, has much lower dose rates.

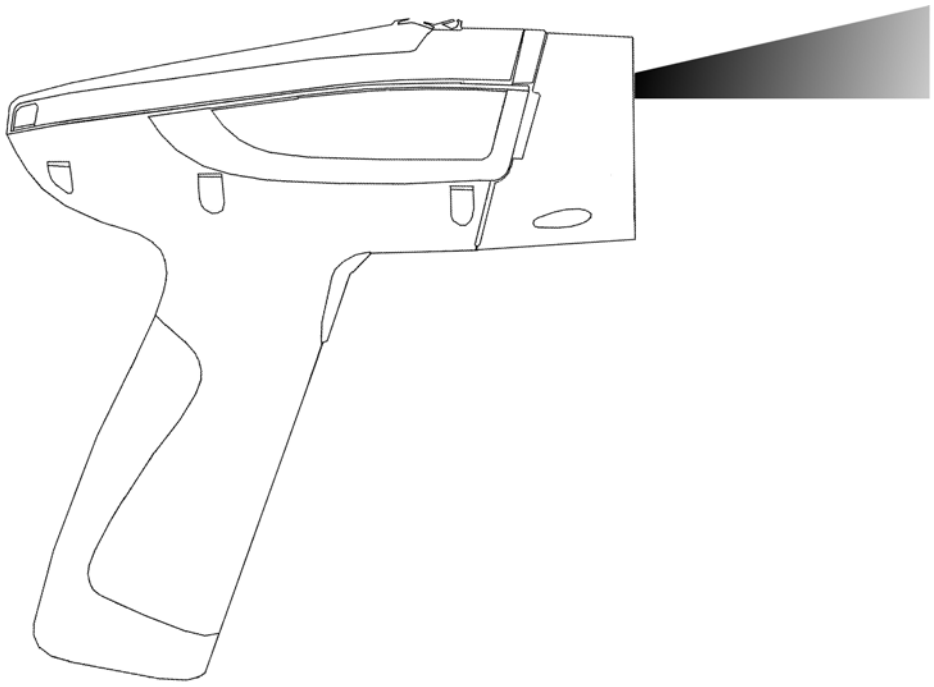


Figure 3-1. . Primary Beam

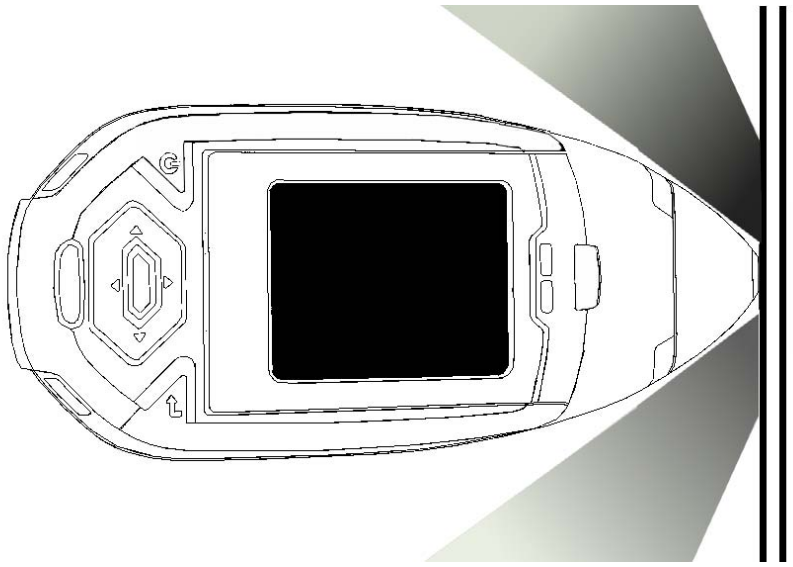


Figure 3-2. Secondary (Scattered) Beam

The Shutter-Open Indicator Lights

When the lights are flashing, the primary beam is on, the shutter is open, and radiation is being emitted from the front of the analyzer. (This does not include the brief flash of the lights when first turning the analyzer on.)

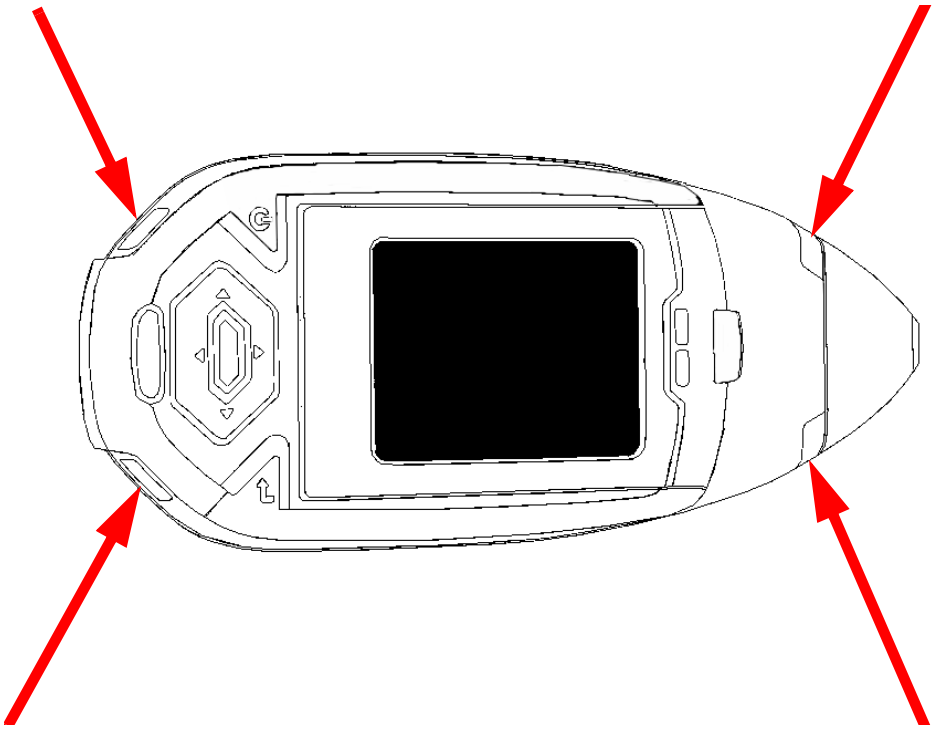


Figure 3-3. X-ray BeamThe Shutter Open Indicator Lights

Handle and Use with Respect

Avoid holding the front of the analyzer when the x-ray tube is energized and the shutter is open. Never point the instrument at yourself or anyone else when the shutter is open and the x-ray tube is energized. Never look into the path of the primary beam.

Follow a Radiation Protection Program

Your organization should establish, document, and follow a Radiation Protection Program. An example of such a program can be found on the resource CD (provided with the instrument).

Take Proper Care of your NITON XL3t Analyzer

Keeping your analyzer maintained in good condition will help minimize the risk of accidental exposure. Mechanical malfunction of the shutter can be avoided by maintaining the Kapton window, as described in the User Guide. This prevents foreign objects from entering your XL3t.

Avoid Over-Exposures

Direct contact with the window could result in overexposures in the times indicated in Table 0-4 below.

Table 3-3. Potential Exposure Limit Times

Location of Dose	Limit	Time to Reach Limit
Deep Dose / Whole Body	5 rem (50 mSv)	2.1 minutes
Shallow Dose / Extremities	50 rem (500 mSv)	0.95 minutes
Member of Public (i.e. untrained operator)	0.1 to 5 rem (1 to 50 mSv)	2.5 to 9.5 seconds

Extremity is defined by the NRC as the hand, elbow, arm below the elbow, foot, knee, or leg below the knee. Whole Body is defined by the NRC as the head, trunk (including male gonads), arms above the elbow, or legs above the knee.

Safe Handling of Samples

As mentioned many times in this chapter, never place any part of your body in the path of the x-ray beam. There is always a safe way to handle samples whether they are small, irregularly shaped, or of low density. Never look into the path of the primary beam.

Small Samples

A small sample would be any sample that is smaller than the Kapton window. Small samples present a unique risk because they don't block the entire beam path. The difficulty with placing small samples down on a work surface to analyze them is that you may get readings from the work surface that interfere with analytical results. A test stand is an effective way of analyzing small samples accurately and safely. Never hold samples during analysis or look into the path of the primary beam.

Irregularly Shaped Samples

Irregularly shaped samples may not allow the proximity button to be depressed, or they may not entirely cover the primary beam and cause additional scattering. A back scatter shield is a safe way of reducing your radiation exposure while effectively analyzing an irregularly shaped sample.

Low Density Materials (such as plastics)

X-rays are attenuated more through denser materials and less through low density materials such as plastic. This causes higher dose rates in the scattered radiation. If you are frequently handling low density samples, you should consider the use of test stands, backscatter shields, or the equivalent.

Radiation Profile

Table 3-4, Table 3-5, Table 3-6 and Table 3-7 below describes the external radiation dose rates that are present at various points in space around the NITON XL3t analyzer when it is being used. Figure 3-4 illustrates where these dose rate points are relative to the analyzer.

Table 3-4. Primary Beam Dose Rates in mSv/hr

Max Power Settings	Max Power Settings		Window Contact Deep	Window Contact Shallow	5 cm Deep	30 cm Deep
kVp	μA	Max in Following Modes* (Filter)	(mSv/hr)	(mSv/hr)	(mSv/hr)	(mSv/hr)
40	50	G, D, E, A, P, F, M, J (Main Filter)	1,410	1,410	50.00	6.3
40	50	B (Main Filter)	750	2,250	40.00	5.4
50	40	H (Main Filter), D, E, M, J (High Filter)	1,090	4,060	84.0	12.2
20	100	D, H, E, M, J (Low Filter)	1,450	31,717	5.2	0.5
15	100	A, B (Low Filter)	133	10,567	4.3	0.42

Table 3-5. Primary Beam Dose Rates in Rem/hr

Max Power Settings	Max Power Settings		Window Contact Deep	Window Contact Shallow	5 cm Deep	30 cm Deep
kVp	μA	Max in Following Modes* (Filter)	(Rem/hr)	(Rem/hr)	(Rem/hr)	(Rem/hr)
40	50	G, D, E, A, P, F, M, J (Main Filter)	141	141	5.00	0.63
40	50	B (Main Filter)	75	2,25	4.00	0.54
50	40	H (Main Filter), D, E, M, J (High Filter)	109	406	8.4	1.22
20	100	D, H, E, M, J (Low Filter)	145	3,171.7	0.52	0.05
15	100	A, B (Low Filter)	13.3	1,056.7	0.43	0.042

* G = Alloy, B = Alloy Electronics, F = Dental Alloy, P = Precious Metals, M = Mining, D = Soil, J = Exploration, A = Lead Paint, E = Thin Sample, H = Plastic

Table 3-6. Secondary (Scatter) Dose Rates (μSv/hr)

kVp	μA	Max in Following Modes* (Filter)	Substrate	Max @ 5cm (μSv/hr) Point A	Max @ 30 cm (μSv/hr) Point A′	Max @ Trigger (μSv/hr) Point B
40	50	G, D, E, A, P, F, M, J (Main Filter)	Aluminum	25	2	0.5
40	50	G, D, E, A, P, F, M, J (Main Filter)	Stainless	16	1.2	0.1
40	50	B (Main Filter)	Aluminum	4	0.4	0.1
40	50	B (Main Filter)	Stainless	1.4	0.1	0.1
50	40	H (Main Filter), D, E, M, J (High Filter)	Plastic	400	35	20
50	40	H (Main Filter), D, E, M, J (High Filter)	Soil	80	4	0.7
20	100	D, H, E, M, J (Low Filter)	Aluminum	0.15	0.1	0.1
20	100	D, H, E, M, J (Low Filter)	Stainless	0.15	0.1	0.1
20	100	D, H, E, M, J (Low Filter)	Plastic	1.3	0.15	0.15
20	100	D, H, E, M, J (Low Filter)	Soil	0.15	0.15	0.15
15	100	A, B (Low Filter)	Aluminum	0.15	0.15	0.15
15	100	A, B (Low Filter)	Stainless	0.15	0.15	0.15

* G = Alloy, B = Alloy Electronics, F = Dental Alloy, P = Precious Metals, M = Mining, D = Soil, J = Exploration, A = Lead Paint, E = Thin Sample, H = Plastic.

Table 3-7. Secondary (Scatter) Dose Rates (mRem/hr)

kVp	uA	Max in Following Modes* (Filter)	Substrate	Max @ 5cm (mRem/hr) Point A	Max @ 30 cm (mRem/hr) Point A'	Max @ Trigger (mRem/hr) Point B
40	50	G, D, E, H, A, P, F, M, J (Main Filter)	Aluminum	2.5	0.2	0.05
40	50	G, D, E, H, A, P, F, M, J (Main Filter)	Stainless	1.6	0.12	0.01
40	50	B (Main Filter)	Aluminum	0.4	0.04	0.01
40	50	B (Main Filter)	Stainless	0.14	0.01	0.01
50	40	H (Main Filter), D, E, M, S, J (High Filter)	Plastic	40	3.5	2
50	40	H (Main Filter), D, E, M, S, J (High Filter)	Soil	8	0.4	0.7
20	100	D, H, E, M, S, J (Low Filter)	Aluminum	0.015	0.01	0.01
20	100	D, H, E, M, S, J (Low Filter)	Stainless	0.015	0.01	0.01
20	100	D, H, E, M, S, J (Low Filter)	Plastic	0.13	0.015	0.015
20	100	D, H, E, M, S, J (Low Filter)	Soil	0.015	0.015	0.015
15	100	A, B (Low Filter)	Aluminum	0.015	0.015	0.015
15	100	A, B (Low Filter)	Stainless	0.015	0.015	0.015

* G = Alloy, B = Alloy Electronics, F = Dental Alloy, P = Precious Metals, M = Mining, D = Soil, J = Exploration, A = Lead Paint, E = Thin Sample, H = Plastic.

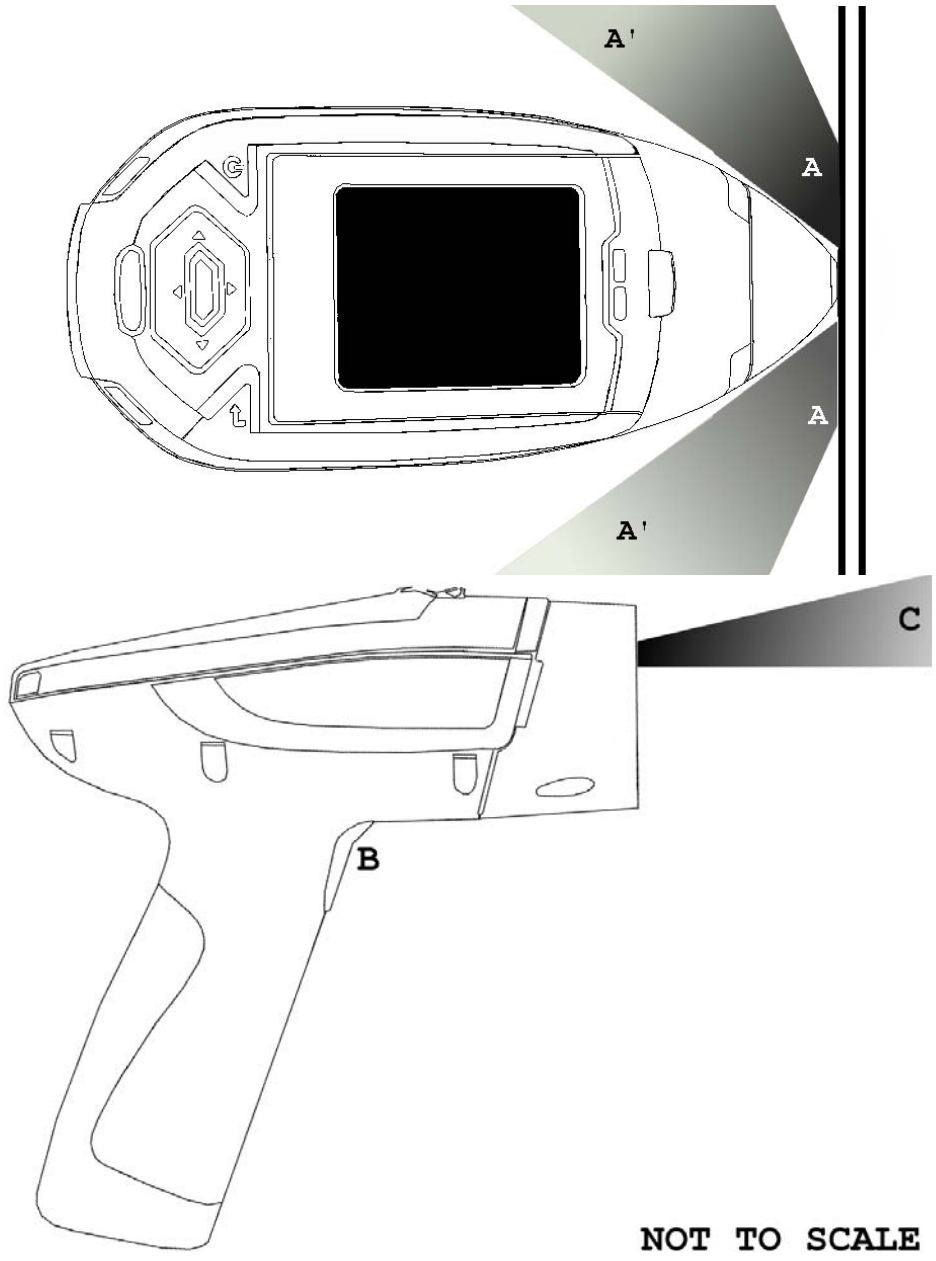


Figure 3-4. Primary & Secondary Dose Rate Locations

Primary Radiation

Primary radiation is radiation that is produced by the analyzer and emitted out through the kapton measurement window. Individuals should never place any part of their body in the primary beam path when the x-ray tube is on. There should always be a sample in contact with the measurement window when the x-ray tube is on. The sample will absorb most of the primary-beam radiation unless it is smaller than the instrument's

measurement window or of low density and/or thickness. Caution should be taken when analyzing samples that are small, thin, and/or low in density as they may allow much more of the primary beam to escape. In-beam primary radiation dose rates are listed in Table 3-4 and Table 3-5 and their location identified relative to the analyzer in Figure 3-4 as Dose Point C.

Secondary Radiation

Under conditions of normal and proper use, individuals can be exposed to secondary (or "scattered") radiation. Secondary radiation is low-level radiation that emanates from the sample being analyzed as a result of primary beam radiation scattering in the sample or primary beam radiation inducing fluorescent x-rays in the sample. Dose points A, A' and B in Figure 3-4 are examples of where you can encounter secondary radiation. The magnitude of this secondary radiation is sample dependent. Higher density samples such as steel will emit the lowest levels as they absorb most primary and secondary radiations. Lower density samples such as aluminum, wood, and especially plastic, will produce higher levels of secondary radiation. Secondary radiation dose rates are listed in Table 3-6 and Table 3-7 for a few common sample types over a wide range of densities.

The operator is reminded that one should never hold samples during analysis, doing so will result in higher than necessary exposure to secondary radiation and could expose the operator directly to the much higher primary-beam dose rates.

Deep and Shallow Dose

You will find in Table 3-4 and Table 3-5 that shallow dose rates are listed for some dose points. All dose rates listed in Table 3-4 and Table 3-5 are deep dose unless they are specifically identified as shallow dose. Deep dose is dose from penetrating radiation that is delivered to both skin and underlying tissues and organs and is the type most commonly referred to when describing external radiation hazards. Occupational deep dose is limited to a maximum of 5 rem (50 mSv) per year in the United States and most countries internationally. Deep dose is measured at 1.0 cm below the skin surface.

Shallow dose is often referred to as "skin dose" because it is a result of low penetrating radiation that only interacts with the skin. Shallow dose is limited to a maximum of 50 rem (500 mSv) per year in the United States and most countries internationally. Shallow dose is listed below for primary in-beam dose points only because the low penetrating radiation that causes shallow dose is nearly all absorbed by a sample and does not produce any significant secondary radiation. Shallow dose is measured at a point 0.007 cm below the surface.

Storage & Transportation

Storage

Regulations in nearly all locations will require that you store your analyzer locked in a secured area to prevent access, use, and/or removal by unauthorized individuals. Storage requirements will vary by location, particularly with regard to storage at temporary job sites or away from your primary storage location such as hotels and motels and in vehicles. You should contact your local Radiation Control Authority to identify the specific storage requirements in your jurisdiction.

Transportation

There are no specific US Department of Transportation (DOT) or International Air Transport Association (IATA) radiation regulations regarding shipping the NITON XL3t analyzer. It is recommended that you ship the XL3t in its carrying case and an over-pack to protect the sensitive measuring equipment inside the analyzer.

Do NOT ship the analyzer with the battery pack connected to the analyzer.

EMERGENCY PROCEDURES

THIS PAGE CONTAINS EMERGENCY CONTACT INFORMATION THAT SHOULD BE AVAILABLE TO THE OPERATOR AT ALL TIMES.

Lost or Stolen Instrument

If the NITON XL3t analyzer is lost or stolen, notify your Radiation Safety Officer (RSO) or the equivalent responsible individual at your company or institution immediately. Your company's RSO, as well as other important emergency contacts, are listed below. Your company RSO may need to notify the x-ray tube regulatory authority and the local police. It is also recommended that a notification is made to Thermo Fisher Scientific.

Damaged Instrument

Minor Damage

If the instrument is intact but there is indication of an unsafe condition such as a cracked case, a shutter mechanism failure, or the lights remain flashing after a measurement is terminated, follow these steps:

1. **Stop using the instrument**
2. **Remove the battery, the x-ray tube can not produce radiation when the battery is disconnected. The instrument is now safe to handle.**
3. **Place the instrument securely in the holster**
4. **Place the instrument in the carrying case that came with the instrument.**
5. **Notify your Radiation Safety Officer (RSO) or the equivalent responsible individual at your company or institution immediately.**
6. **You or your RSO should call Thermo Fisher Scientific at one of their contact numbers listed below for additional instructions and guidance.**

Major damage

If the instrument is severely damaged:

1. **Perform the same steps as described above for minor damage. There will be no radiation hazard as long as the battery is removed from the instrument.**

2. **Place all components in a plastic bag and contact Thermo Fisher Scientific.**

Emergency Response Information

Please Complete the Following Emergency Response Information and Keep with the Analyzer at All Times

NITON ANALYZER EMERGENCY CONTACT INFORMATION

The Company RSO is:_____

RSO Telephone Number:_____

Regulatory Agency Emergency Number:_____

Local Fire Department:_____

Local or State Police Department:_____

Thermo Fisher Scientific's NITON Analyzer Contact Numbers

Main Number (USA): (800) 875-1578

Service (USA): (401) 294-1234

Additional Radiation Emergency #'s: (978) 790-8269 or (617) 901-3125

Outside the USA - Local NITON Service Center:_____

For assistance with your NITON XL3t analyzer outside the United States, please contact your nearest manufacturer's service center identified below:

Europe

NITON Analyzers Europe

Munich, Germany

Phone: +49 89 3681 380

Fax: +49 89 3681 3830

Email: niton.eur@thermo.com

Asia NITON Analyzers Asia

Hong Kong

Phone: +852 2869-6669

Fax: +852 2869-6665

Email: niton.asia@thermo.com

Registration and Licensing

As a user of a NITON XL3t analyzer, you may be required to register or obtain a license with your local radiation control authority. In the US, if you intend to do work with your XL3t in states other than your own, you may be required to register there as well. Below is a list of commonly asked questions that come up when filling out registration forms.

FAQ

What is the max mA, max kVp, and max power?

Maximum mA is 0.1 mA

Maximum kVp is 50 kVp

Maximum power: 2 watts

What is the accelerator voltage or MeV?

This should be filled out as not applicable N/A as it does not apply to XL3t analyzers.

What is the radioisotope?

There are no radioactive isotopes in XL3t analyzers.

What category is the XL3t?

States differ greatly in their categories; the following is a list of common categories:

- o X-Ray Fluorescence
- o Analytical or Analytical XRF
- o Open Beam or Open Beam Analytical
- o Portable Gauge or Portable XRF
- o Industrial Analytical or Non-Destructive Testing

When selecting the category make sure that you don't select medical or radiographic.

How many tubes are in the XL3t?

One.

What is the analyzer serial number?

The serial number is a 5 digit number located on the yellow sticker on the underside of your analyzer.

What is the tube serial number?

The serial number on the tube is different from the serial number on the analyzer itself. If your jurisdiction asks for this number please call us at 1-800-875-1578 and ask to speak with someone regarding X-Ray tube registrations and we can look this number up for you.

What is the type of X-Ray Processing?

None. XL3t analyzers do not use film.

How often do I need to perform leak tests on the XL3t?

Never. Leak tests are only required for analyzers with radioactive isotopes. XL3t analyzers do not have radioactive isotopes.

Regarding Safety Devices for the Open Beam Configuration:

In the US, you may be required to file for an exemption, "variance letter", with your state if there is a requirement for a safety device that would prevent entry of an extremity into the primary beam. If you need assistance with the exemption letter, you may contact the radiation safety group.

Contact Information

If you have additional questions, please feel free to contact the Radiation Safety Group. If you have questions about regulatory requirements, we recommend that you contact your local radiation control authority. Contact information is listed below.

Thermo Fisher Scientific Contact Information

Radiation Safety Group

By phone: +1 978-670-7460

By fax: +1 978-670-7430

By e-mail: Radsafety.Billerica@thermofisher.com

Radiation Emergency Numbers (Call only if there is a radiation emergency)

Phone: +1 617-901-3125

Phone: +1 978-790-8269

Service Departments

USA (Rhode Island) Phone:+1 401-294-1234

Fax: +1 401-295-2090

Germany Phone:+49 89 368138-0

Fax:+49 89 368138-30

Hong Kong Phone:+852 2869-6669

Fax:+852 2869-6665

United States Regulatory Authority Contact Information

A list of states and their contacts can be found at the following website:

http://www.hsrd.ornl.gov/nrc/asdirectr.htm

Appendices

Appendix A: X-ray Emission Energies Arranged by Element, by Increasing Atomic Number, in KeV

Table A-1. X-ray Emission Energies Arranged by Element, by Increasing Atomic Number, in KeV

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
potassium	K	19	39.10	3.3	3.6			
calcium	Ca	20	40.08	3.7	4.0			
scandium	Sc	21	44.96	4.1	4.5			
titanium	Ti	22	47.87	4.5	4.9			
vanadium	V	23	50.94	4.9	5.4			
chromium	Cr	24	52.00	5.4	5.9			
manganese	Mn	25	54.94	5.9	6.5			
iron	Fe	26	55.85	6.4	7.1			
cobalt	Co	27	58.93	6.9	7.6			
nickel	Ni	28	58.69	7.5	8.3			
copper	Cu	29	63.55	8.0	8.9			
zinc	Zn	30	65.41	8.6	9.6			
gallium	Ga	31	69.72	9.2	10.3			
germanium	Ge	32	72.64	9.9	11.0			
arsenic	As	33	74.92	10.5	11.7			
selenium	Se	34	78.96	11.2	12.5			
bromine	Br	35	79.90	11.9	13.3			
krypton	Kr	36	83.80	12.6	14.1			
rubidium	Rb	37	85.47	13.4	15.0			
strontium	Sr	38	87.62	14.2	15.8			
yttrium	Y	39	88.91	15.0	16.7			
zirconium	Zr	40	91.22	15.8	17.7			
niobium	Nb	41	92.91	16.6	18.6			
molybdenum	Mo	42	95.94	17.5	19.6			
technetium	Tc	43	98.00	18.4	20.6	2.4	2.5	2.8
ruthenium	Ru	44	101.07	19.3	21.7	2.6	2.6	3.0

Table A-1. X-ray Emission Energies Arranged by Element, by Increasing Atomic Number, in KeV

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
rhodium	Rh	45	102.91	20.2	22.7	2.7	2.8	3.1
palladium	Pd	46	106.42	21.2	23.8	2.8	3.0	3.3
silver	Ag	47	107.87	22.2	25.0	3.0	3.2	3.5
cadmium	Cd	48	112.41	23.2	26.1	3.1	3.3	3.7
indium	In	49	114.82	24.2	27.3	3.3	3.5	3.9
Tin	Sn	50	118.71	25.3	28.5	3.4	3.7	4.1
antimony	Sb	51	121.76	26.4	29.7	3.6	3.8	4.3
tellurium	Te	52	127.60	27.5	31.0	3.8	4.0	4.6
iodine	I	53	126.90	28.6	32.3	3.9	4.2	4.8
xenon	Xe	54	131.29	29.8	33.6	4.1	4.4	5.0
cesium	Cs	55	132.91	31.0	35.0	4.3	4.6	5.3
barium	Ba	56	137.33	32.2	36.4	4.5	4.8	5.5
lanthanum	La	57	138.91	33.4	37.8	4.7	5.0	5.8
cerium	Ce	58	140.12	34.7	39.3	4.8	5.3	6.0
praseodymium	Pr	59	140.91	36.0	40.7	5.0	5.5	6.3
neodymium	Nd	60	144.24	37.4	42.3	5.2	5.7	6.6
promethium	Pm	61	145.00	38.6	44.0	5.4	6.0	6.9
samarium	Sm	62	150.36	40.1	45.4	5.6	6.2	7.2
europium	Eu	63	151.96	41.5	47.0	5.8	6.5	7.5
gadolinium	Gd	64	157.25	43.0	48.7	6.1	6.7	7.8
terbium	Tb	65	158.92	44.5	50.4	6.3	7.0	8.1
dysproium	Dy	66	162.50	46.0	52.2	6.5	7.3	8.4
holmium	Ho	67	164.93	47.5	53.9	6.7	7.5	8.7
erbium	Er	68	167.26	49.1	55.7	6.9	7.8	9.1
thulium	Tm	69	168.93	50.7	57.6	7.2	8.1	9.4
ytterbium	Yb	70	173.04	52.4	59.4	7.4	8.4	9.8
lutetium	Lu	71	174.97	54.1	61.3	7.7	8.7	10.1
hafnium	Hf	72	178.49	55.8	63.2	7.9	9.0	10.5
tantalum	Ta	73	180.95	57.5	65.2	8.1	9.3	10.9
tungsten	W	74	183.84	59.3	67.2	8.4	9.7	11.3
rhenium	Re	75	186.20	61.1	69.3	8.7	10.0	11.7
osmium	Os	76	190.23	63.0	71.4	8.9	10.4	12.1
iridium	Ir	77	192.22	64.9	73.6	9.2	10.7	12.5

Table A-1. X-ray Emission Energies Arranged by Element, by Increasing Atomic Number, in KeV

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
platinum	Pt	78	195.09	66.8	75.7	9.4	11.1	12.9
gold	Au	79	196.97	68.8	78.0	9.7	11.4	13.4
mercury	Hg	80	200.59	70.8	80.3	10.0	11.8	13.8
thallium	Tl	81	204.38	72.9	82.6	10.3	12.2	14.3
lead	Pb	82	207.20	75.0	85.9	10.5	12.6	14.8
bismuth	Bi	83	208.98	77.1	87.3	10.8	13.0	15.2
polonium	Po	84	(209.0)	79.3	89.8	11.1	13.4	15.7
astatine	At	85	(210.0)	81.5	92.3	11.4	13.9	16.2
radon	Rn	86	(222.0)			11.7	14.3	16.8
francium	Fr	87	(223.0)			12.0	14.8	17.3
radium	Ra	88	(226.0)			12.3	15.2	17.8
actinium	Ac	89	(227.0)			12.7	15.7	18.4
thorium	Th	90	232.04			13.0	16.2	19.0
protactinium	Pa	91	(231.0)			13.3	16.7	19.6
uranium	U	92	238.03			13.6	17.2	20.2
neptunium	Np	93	237.00			13.9	17.7	20.8
plutonium	Pu	94	244.00			14.3	18.3	21.4

Appendix B: X-ray Emission Energies Arranged Alphabetically by Element, by name

Table A-2. X-ray Emission Energies Arranged Alphabetically by Element, by name

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
actinium	Ac	89	(227.0)			12.7	15.7	18.4
antimony	Sb	51	121.76	26.4	29.7	3.6	3.8	4.3
arsenic	As	33	74.92	10.5	11.7			
astatine	At	85	(210.0)	81.5	92.3	11.4	13.9	16.2
barium	Ba	56	137.33	32.2	36.4	4.5	4.8	5.5
bismuth	Bi	83	208.98	77.1	87.3	10.8	13.0	15.2
bromine	Br	35	79.90	11.9	13.3			
cadmium	Cd	48	112.41	23.2	26.1	3.1	3.3	3.7
calcium	Ca	20	40.08	3.7	4.0			
cerium	Ce	58	140.12	34.7	39.3	4.8	5.3	6.0
cesium	Cs	55	132.91	31.0	35.0	4.3	4.6	5.3
chromium	Cr	24	52.00	5.4	5.9			
cobalt	Co	27	58.93	6.9	7.6			
copper	Cu	29	63.55	8.0	8.9			
dysproium	Dy	66	162.50	46.0	52.2	6.5	7.3	8.4
erbium	Er	68	167.26	49.1	55.7	6.9	7.8	9.1
europium	Eu	63	151.96	41.5	47.0	5.8	6.5	7.5
francium	Fr	87	(223.0)			12.0	14.8	17.3
gadolinium	Gd	64	157.25	43.0	48.7	6.1	6.7	7.8
gallium	Ga	31	69.72	9.2	10.3			
germanium	Ge	32	72.64	9.9	11.0			
gold	Au	79	196.97	68.8	78.0	9.7	11.4	13.4
hafnium	Hf	72	178.49	55.8	63.2	7.9	9.0	10.5
holmium	Ho	67	164.93	47.5	53.9	6.7	7.5	8.7
indium	In	49	114.82	24.2	27.3	3.3	3.5	3.9
iodine	I	53	126.90	28.6	32.3	3.9	4.2	4.8
iridium	Ir	77	192.22	64.9	73.6	9.2	10.7	12.5
iron	Fe	26	55.85	6.4	7.1			
krypton	Kr	36	83.80	12.6	14.1			
lanthanum	La	57	138.91	33.4	37.8	4.7	5.0	5.8
lead	Pb	82	207.20	75.0	85.9	10.5	12.6	14.8
lutetium	Lu	71	174.97	54.1	61.3	7.7	8.7	10.1

Table A-2. X-ray Emission Energies Arranged Alphabetically by Element, by name

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
manganese	Mn	25	54.94	5.9	6.5			
mercury	Hg	80	200.59	70.8	80.3	10.0	11.8	13.8
molybdenum	Mo	42	95.94	17.5	19.6			
neodymium	Nd	60	144.24	37.4	42.3	5.2	5.7	6.6
nickel	Ni	28	58.69	7.5	8.3			
niobium	Nb	41	92.91	16.6	18.6			
osmium	Os	76	190.23	63.0	71.4	8.9	10.4	12.1
palladium	Pd	46	106.42	21.2	23.8	2.8	3.0	3.3
platinum	Pt	78	195.09	66.8	75.7	9.4	11.1	12.9
polonium	Po	84	(209.0)	79.3	89.8	11.1	13.4	15.7
potassium	K	19	39.10	3.3	3.6			
praseodymium	Pr	59	140.91	36.0	40.7	5.0	5.5	6.3
promethium	Pm	61	145.00	38.6	44.0	5.4	6.0	6.9
protactinium	Pa	91	(231.0)			13.3	16.7	19.6
radium	Ra	88	(226.0)			12.3	15.2	17.8
radon	Rn	86	(222.0)			11.7	14.3	16.8
rhenium	Re	75	186.20	61.1	69.3	8.7	10.0	11.7
rhodium	Rh	45	102.91	20.2	22.7	2.7	2.8	3.1
rubidium	Rb	37	85.47	13.4	15.0			
ruthenium	Ru	44	101.07	19.3	21.7	2.6	2.6	3.0
samarium	Sm	62	150.36	40.1	45.4	5.6	6.2	7.2
scandium	Sc	21	44.96	4.1	4.5			
selenium	Se	34	78.96	11.2	12.5			
silver	Ag	47	107.87	22.2	25.0	3.0	3.2	3.5
strontium	Sr	38	87.62	14.2	15.8			
tantalum	Ta	73	180.95	57.5	65.2	8.1	9.3	10.9
technetium	Tc	43	98.00	18.4	20.6	2.4	2.5	2.8
tellurium	Te	52	127.60	27.5	31.0	3.8	4.0	4.6
terbium	Tb	65	158.92	44.5	50.4	6.3	7.0	8.1
thallium	Tl	81	204.38	72.9	82.6	10.3	12.2	14.3
thorium	Th	90	232.04			13.0	16.2	19.0
thulium	Tm	69	168.93	50.7	57.6	7.2	8.1	9.4
Tin	Sn	50	118.71	25.3	28.5	3.4	3.7	4.1

Table A-2. X-ray Emission Energies Arranged Alphabetically by Element, by name

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
titanium	Ti	22	47.87	4.5	4.9			
tungsten	W	74	183.84	59.3	67.2	8.4	9.7	11.3
uranium	U	92	238.03			13.6	17.2	20.2
vanadium	V	23	50.94	4.9	5.4			
xenon	Xe	54	131.29	29.8	33.6	4.1	4.4	5.0
ytterbium	Yb	70	173.04	52.4	59.4	7.4	8.4	9.8
yttrium	Y	39	88.91	15.0	16.7			
zinc	Zn	30	65.41	8.6	9.6			
zirconium	Zr	40	91.22	15.8	17.7			

Appendix C: SpectraView

SpectraView enables you to qualitatively analyze the fluorescent x-rays of most of the elements in the periodic table. For a complete list of elements and their fluorescent x-rays see Appendix A. In SpectraView Mode, the spectrum is displayed in a linear scale, autoscaled logarithmically so that the highest peak on the screen reaches the top of the scale.

How to Use SpectraView

You can access the SpectraView screen after taking a measurement in any mode, or while viewing a previous measurement, by selecting Spectra from the NAV Menu. Once you are in SpectraView, you can use the up and down positions of the 4-way touch pad to scroll through the spectrum, or you can tap on the spectrum display with the stylus to place the cursor at the point you tapped. The vertical cursor line indicates the current position along the spectrum.

Viewing the Information in SpectraView Mode

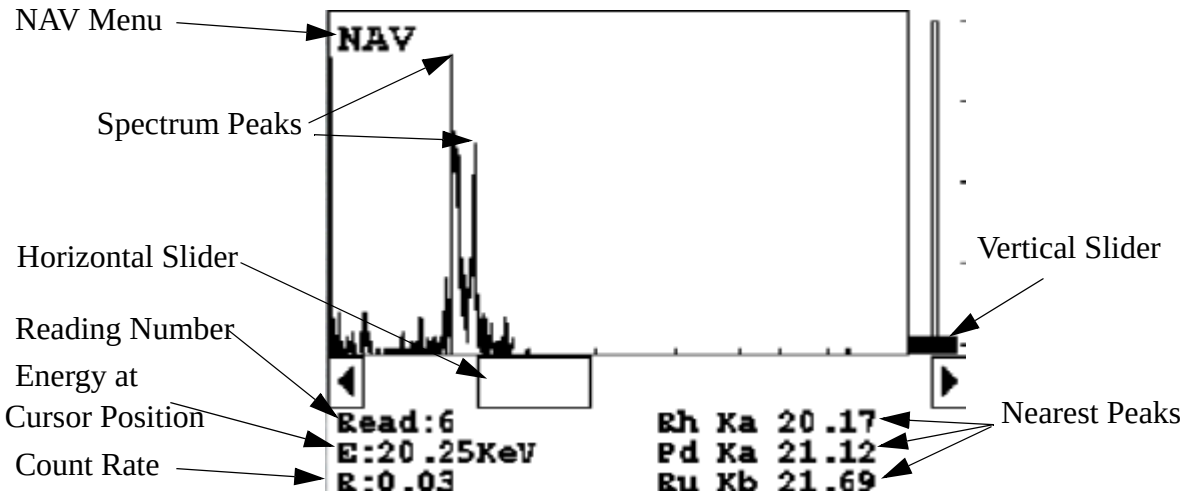


Figure A-1. The SpectraView Screen

By default, the following information is shown along with the spectrum:

The Reading number (Bottom Left) in the form "Read:x", where x is the Reading number.

The position of the cursor on the energy scale (Bottom Left, under the Reading number), in the form "E: x.xx KeV", where KeV is thousands of electron volts.

The **count rate** (Bottom Left, under the energy position), in the form “R:x.xx”.

Ka, Kb, La, Lb, and/or **Lg** peaks of the three elements closest to where your cursor is positioned on the energy scale (Bottom Right). This information is written with the element symbol first, followed by either Ka (K shell alpha peak), Kb (K shell beta peak), La (L shell alpha peak), La (L shell beta peak), or Lg (L shell gamma peak). An example would be "Al Ka 1.5." To determine if a given element is present, look at the count rate at that cursor position.

SpectraView cannot be used to determine exact element percentages in a sample.

Multiple Spectra

SpectraView can display the reading spectra from multiple sources if your analyzer has more than one X-ray source or filter. Use the NAV Menu to select which spectrum to view.

The “Spectra1” choice will display the display the spectrum produced by excitation from the first source tube setting.

The “Spectra2” choice will display the display the spectrum produced by excitation from the second source tube setting.

The “Spectra3” choice will display the display the spectrum produced by excitation from the third source tube setting.

SpectraView Navigation

Use the left button on the 4-way touch pad to expand the spectrum, centered on the position of the cursor.

Use the right button on the 4-way touch pad to contract the spectrum, centered on the position of the cursor.

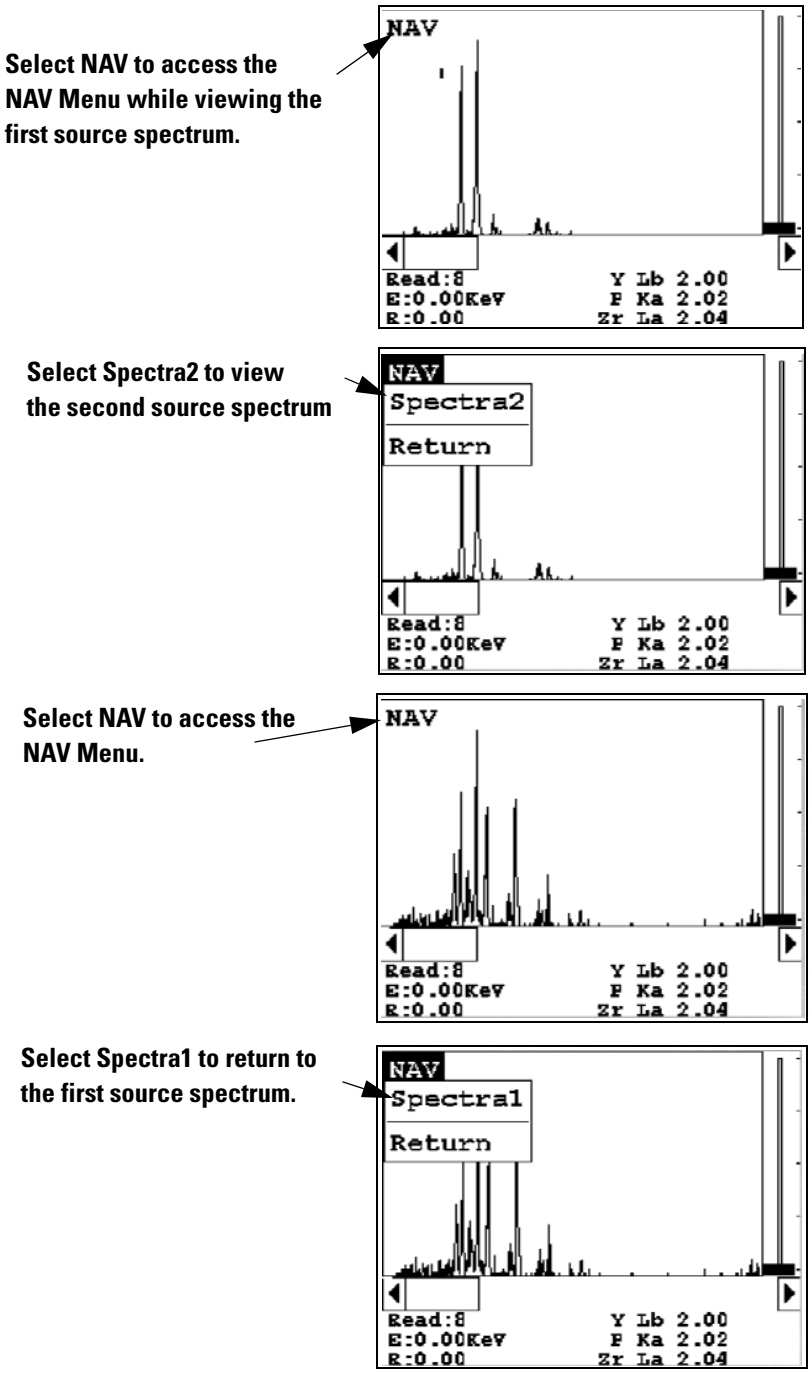


Figure A-2. Viewing Multiple Spectra

Appendix D: Summary of Warnings

WARNING! Do not attempt to use this instrument without first reading and understanding the entire User's Guide! ♦

WARNING! Always treat radiation with respect. Do not hold your instrument near the Kapton window during testing. Never point your instrument at yourself or anyone else when the shutter is open. ♦

WARNING! Do not attempt to take measurements while downloading readings! This will generate an error requiring a system reset, and may corrupt your stored readings, requiring all stored readings to be erased. ♦

WARNING! All Service, except exterior cleaning and Kapton window replacement, must be performed by Thermo Scientific. Do not attempt to make repairs yourself. Opening the case of your NITON will void the instrument Warranty in its entirety. ♦

WARNING! The preconditions for operation must be continued for the duration of the reading. If the preconditions are violated, the x-ray tube will turn off, the calibration shutter will close, and the measurement will end. The four LED lights will stop blinking when the measurement is ended. The flashing of the LED lights is not synchronized to minimize power consumption. ♦

WARNING! In the highly unlikely event that the x-ray tube remains on when the trigger is not depressed, disconnect the battery pack immediately to turn off the x-ray tube, and call Thermo Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States at +1-978-670-7460, or your local Authorized NITON Analyzers Service Center. ♦

WARNING! When all four LED lights are blinking, the x-ray tube is on. This should only occur during a measurement, while the preconditions for operation are met. On startup, the front pair of lights will blink. If the LED lights blink at any other time, disconnect the battery pack and call Thermo Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, or your local Authorized NITON Analyzer Service Center. ♦

WARNING! Thickness correction is only for use with plastic/polymer samples. ♦

Appendix E: Summary of Cautions

CAUTION Never turn off the instrument while data is being erased! ♦

CAUTION Whenever you turn on your NITON XL3 Alloy and Plastics Analyzer after it has been off for more than 30 minutes, you should measure your check sample to assure proper operation. If the instrument is not reading properly, you should re-calibrate your NITON XL3 Analyzer's sample analysis electronics before you start to take readings. When the instrument is turned on after being off for more than 30 minutes, your NITON analyzer will require a 10 minute warm-up period before the instrument can be calibrated, unless this 10 minute warm-up period is manually overridden.

CAUTION Do not leave the battery pack connected to the charger for excessive periods of time. Overnight recharging is recommended. ♦

CAUTION Store the instrument and the spare battery packs in a cool place, away from direct sunlight. ♦

CAUTION Always transport the unit in its padded carrying case, and store the NITON Analyzer in its case whenever it is not being used. ♦

CAUTION Do not let the battery pack recharge for excessive periods of time. ♦

CAUTION In most cases, no notification is required if transporting within state boundaries. This may not be the case when entering federal properties. ♦

CAUTION Do not store battery packs or charger in direct sunlight. ♦

CAUTION Always follow all pertinent local and national regulations and guidelines, wherever your XL3 analyzer is transported or used. ♦

CAUTION Always obtain a Return Authorization (RA) number from Thermo Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460 before returning your instrument to the Service Department or to your local Authorized NITON Analyzers Service Center. ♦

CAUTION If you return your NITON instrument without the carrying case, you will void your NITON Analyzer's warranty in its entirety. You will be billed for a replacement case plus any repairs resulting from improper shipping. ♦

CAUTION Always remove the battery pack when transporting or storing your instrument. ♦

CAUTION Avoid any vibration, loud noise, strong electronice fields, or other possible interference when your analyzer is calibrating its detector. ♦

CAUTION NITON Analyzers are not intrinsically safe analyzers in regard to sparking. All pertinent Hot Work procedures should be followed in areas of concern. ♦

CAUTION When teaching your analyzer a new alloy signature in **Match Signature Mode**, the measurement must be taken for at least a full 60 nominal seconds, as displayed on your analyzer's touch screen display. ♦

CAUTION After being powered on, your NITONnalyzer will perform an internal re-calibration before an analysis is initiated. It is recommended that you let your analyzer warm up for ten minutes after start up, before testing is begun. ♦

CAUTION Within the United States, always keep a copy of the US DOT compliance statement in your NITON analyzer case at all times. A copy is included with your analyzer. ♦

Appendix F: Warranty

Thermo Fisher Scientific will warranty parts and labor for any manufacturer's defects for two years (24 months). No precision instrument is warranted if crushed, dropped on the floor or in a bucket of water. All service, including repairs and routine maintenance, and x-ray tube replacement or re-sourcing, must be performed by Thermo Fisher Scientific or by an Authorized NITON Analyzer Service Facility. Any attempt to open the sealed plastic housing of your NITON instrument will nullify the instrument warranty in its entirety.

Limited Warranty Provision for Use with Purchase and License Agreement for Thermo Scientific XRF Detection instruments:

Except as otherwise agreed in writing, Thermo Fisher Scientific warrants, under normal conditions of operation, each product sold (except for components not of its manufacture) against defects of material and workmanship, provided that such product has been properly utilized. This warranty applies to the original purchaser only and shall commence to run from the date of shipment and shall continue for a period of twenty-four (24) months. In any event, Thermo Fisher's liability for any such defects of material and workmanship shall not exceed the cost of replacement of defective parts upon timely notification of such defect in writing delivered to Thermo Fisher's home office. Thermo Fisher shall not be liable for damage or destruction caused during delivery or caused other than by employees of Thermo Fisher Scientific.

Material, accessories, parts, or items of equipment furnished by suppliers to Thermo Fisher and used in the manufacture of Thermo Fisher products are guaranteed by Thermo Fisher Scientific only to the extent of the original manufacturer's express warranty to Thermo Fisher for a period not to exceed the warranty period described in paragraph (a) above and provided that the purchaser shall have notified Thermo Fisher so as to enable Thermo Fisher to avail itself of its rights under such original manufacturer's express warranty.

Specific warranties of some common accessories:

- Battery Charger 12 months
- Batteries 12 months
- Soil Grinder no warranty
- Single-stage helium tank regulator 12 months
- Two-stage helium tank regulator 12 months

Thermo Fisher Scientific shall, at its option, repair such defects or replace the parts or products found defective. All defective parts are to be returned, freight prepaid, immediately to Thermo Fisher for inspection and credit. Thermo Fisher will make no allowance for repairs or alterations made by the purchaser unless made with the advance written consent of Thermo Fisher.

Thermo Fisher Scientific assumes no liability for costs of disassembly of defective parts and equipment. Shipment by purchaser of all repairs and replacements under this warranty are F.O.B. Thermo Fisher Scientific's factory or authorized service representative and method of shipment will be determined by Thermo Fisher. The purchaser will pay shipping costs and insurance in both directions of products, parts, or components shipped for warranty service hereunder. The purchaser will be responsible for risk of loss in both direction. Replaced parts or components will become the property of Thermo Fisher Scientific. Replacement parts or components may contain recycled, refurbished, or remanufactured parts equivalent to new parts and shall be warranted for the remainder of the original warranty period for the products.

Thermo Fisher Scientific shall not be liable for delays, deprivation of use, or any other damages, direct or indirect, which may result to the purchaser because of defects in the product or because of the purchaser's inability to operate it or use it to his satisfaction. Thermo Fisher Scientific will not be liable to anyone for special or consequential damages of any kind. Thermo Fisher neither assumes nor authorizes any person to assume for it, any other obligation or liability with respect to Thermo Fisher products.

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Appendix F:

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