FocusPC
UT and Phased Array Data Acquisition and Analysis Software

User's Manual

Software Version 1.0

DMTA-20092-01EN — Rev. G
September 2022

This instruction manual contains essential information on how to use this Evident product safely and effectively. Before using this product, thoroughly review this instruction manual. Use the product as instructed.

Keep this instruction manual in a safe, accessible location.

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This document was prepared with particular attention to usage to ensure the accuracy of the information contained therein, and corresponds to the version of the product manufactured prior to the date appearing on the title page. There could, however, be some differences between the manual and the product if the product was modified thereafter.

The information contained in this document is subject to change without notice.

Software version 1.0
Part number: DMTA-20092-01EN
Rev. G
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Printed in Canada

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List of Abbreviations

CAF	coherent adaptive focusing
FFT	fast Fourier transform
MFC	Microsoft Foundation Class
ML	material loss
SDK	software development kit
TCG	time-corrected gain
USB	universal serial bus

Important Information — Please Read Before Use

Intended Use

FocusPC is a software program designed for FOCUS PX instruments used in nondestructive inspections on industrial and commercial materials.

Instruction Manual

This instruction manual contains essential information on how to use this Evident product safely and effectively. Before using this product, thoroughly review this instruction manual. Use the product as instructed.

Keep this instruction manual in a safe, accessible location.

Software Compatibility

FocusPC is only compatible with FOCUS PX instruments. For a list of models, see Table 1 on page 22.

CAUTION

Always use equipment and accessories that meet Evident specifications. Using incompatible equipment could cause equipment malfunction and/or damage, or human injury.

Safety Symbols

The following safety symbols might appear on the instrument and in the instruction manual:

General warning symbol

This symbol is used to alert the user to potential hazards. All safety messages that follow this symbol shall be obeyed to avoid possible harm or material damage.

Shock hazard caution symbol

This symbol is used to alert the user to potential electric shock hazards. All safety messages that follow this symbol shall be obeyed to avoid possible harm.

Safety Signal Words

The following safety symbols might appear in the documentation of the instrument:

DANGER

The DANGER signal word indicates an imminently hazardous situation. It calls attention to a procedure, practice, or the like that if not correctly performed or adhered to will result in death or serious personal injury. Do not proceed beyond a DANGER signal word until the indicated conditions are fully understood and met.

WARNING

The WARNING signal word indicates a potentially hazardous situation. It calls attention to a procedure, practice, or the like that if not correctly performed or adhered to could result in death or serious personal injury. Do not proceed beyond a WARNING signal word until the indicated conditions are fully understood and met.

CAUTION

The CAUTION signal word indicates a potentially hazardous situation. It calls attention to a procedure, practice, or the like that if not correctly performed or adhered to may result in minor or moderate personal injury, material damage, particularly to the product, destruction of part or all of the product, or loss of data. Do not proceed beyond a CAUTION signal word until the indicated conditions are fully understood and met.

Note Signal Words

The following note signal words could appear in the documentation of the instrument:

IMPORTANT

The IMPORTANT signal word calls attention to a note that provides important information, or information essential to the completion of a task.

NOTE

The NOTE signal word calls attention to an operating procedure, practice, or the like, which requires special attention. A note also denotes related parenthetical information that is useful, but not imperative.

TIP

The TIP signal word calls attention to a type of note that helps you apply the techniques and procedures described in the manual to your specific needs, or provides hints on how to effectively use the capabilities of the product.

Warranty Information

Evident guarantees your Evident product to be free from defects in materials and workmanship for a specific period, and in accordance with conditions specified in the Terms and Conditions available at https://www.olympus-ims.com/en/terms/.

The Evident warranty only covers equipment that has been used in a proper manner, as described in this instruction manual, and that has not been subjected to excessive abuse, attempted unauthorized repair, or modification.

Inspect materials thoroughly on receipt for evidence of external or internal damage that might have occurred during shipment. Immediately notify the carrier making the delivery of any damage, because the carrier is normally liable for damage during shipment. Retain packing materials, waybills, and other shipping documentation needed in order to file a damage claim. After notifying the carrier, contact Evident for assistance with the damage claim and equipment replacement, if necessary.

This instruction manual explains the proper operation of your Evident product. The information contained herein is intended solely as a teaching aid, and shall not be used in any particular application without independent testing and/or verification by the operator or the supervisor. Such independent verification of procedures becomes increasingly important as the criticality of the application increases. For this reason, Evident makes no warranty, expressed or implied, that the techniques, examples, or procedures described herein are consistent with industry standards, nor that they meet the requirements of any particular application.

Evident reserves the right to modify any product without incurring the responsibility for modifying previously manufactured products.

Technical Support

Evident is firmly committed to providing the highest level of customer service and product support. If you experience any difficulties when using our product, or if it fails to operate as described in the documentation, first consult the user's manual, and then, if you are still in need of assistance, contact our After-Sales Service. To locate the nearest service center, visit the Service Centers page on the Evident Scientific Web site.

Introduction

FocusPC is a powerful and versatile ultrasonic and phased array software designed to be the centerpiece of automated inspection systems (Figure i-1 on page 13). Its flexibility and high-end features enable you to perform inspections that meet the most stringent inspection criteria and ever increasing industry requirements.

Figure i-1 Example of a fully automated inspection system[1]

1. Photo courtesy of SCLEAD.

FocusPC is a flexible software designed to perform fast and precise inspections on simple or complex-shaped parts. In order to achieve this, FocusPC can drive one or many FOCUS PX acquisition instruments.

FocusPC offers a flexible graphical user interface allowing you to customize, save, and retrieve layouts containing various views. This manual provides instruction on how to use FocusPC to its full advantage to facilitate your UT inspections.

Using FocusPC with the FOCUS PX

To build systems that reach optimal inspection speeds and detectability, FocusPC is best used with the FOCUS PX (Figure i-2 on page 14). The FOCUS PX is a high speed acquisition instrument that can be used to drive multiple phased array and conventional UT probes; its features are fully exploited within the FocusPC software.

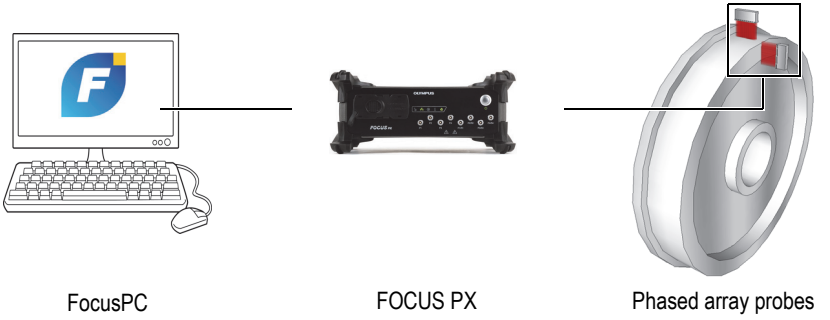

Figure i-2 FocusPC / FOCUS PX system example

Scalability is also a major asset, allowing the adjustment of the number of FOCUS PX instruments used for a system in order to reach the expected system performances (Figure i-3 on page 15).

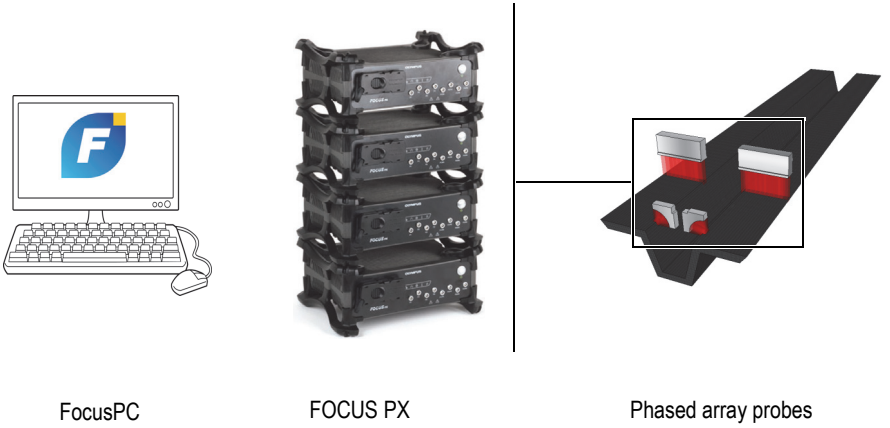

Figure i-3 FocusPC / FOCUS PX system diagram

Building Automated Inspection Systems with the FocusPC SDK

To allow the automation of systems built with FocusPC, two software development kits (SDK) were developed by Evident. These SDKs allow you to customize inspection systems and upgrade from operator-driven to fully automated systems:

- FocusControl is an SDK that includes program samples and the full source code. It allows you to create custom programs that you can use to control FocusPC, or create user interfaces that are dedicated to specific applications (Figure i-4 on page 16). For more details, see “FocusControl SDK” on page 17.

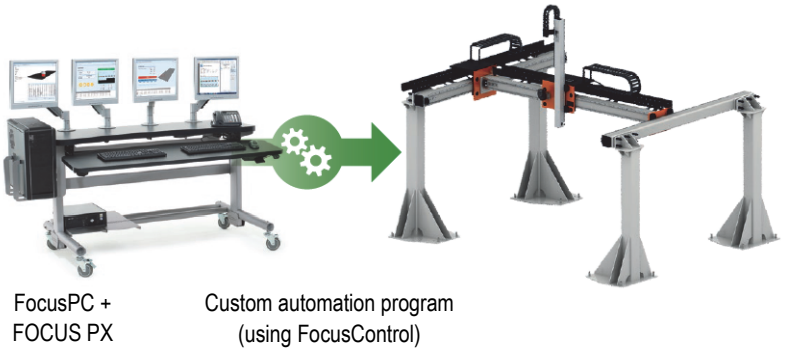

Figure i-4 Example of a system using FocusControl to enable automation

- FocusData is another SDK, which also includes program samples and the full source code. FocusData lets you create custom programs that you can use to extract raw inspection data for custom data processing and presentation (Figure i-5 on page 16). For more details, see “FocusData SDK” on page 18.

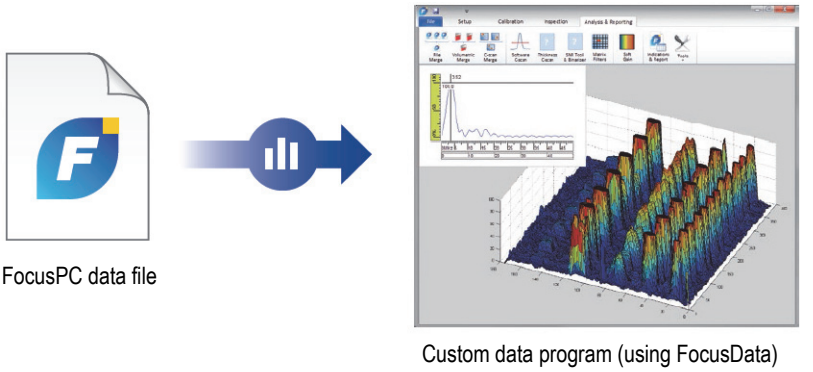

Figure i-5 Example of a custom data presentation using FocusData

FocusControl SDK

Phased array inspection systems are often automated to reduce cycle time and improve system performance. In order to achieve this, custom programs can be built to communicate with FocusPC and control the inspection process.

The FocusControl SDK establishes the link between FocusPC and custom programs, giving a direct control of the inspection process. It also allows the creation of user-defined interfaces that can be built to make the system more convenient to use and optimize the inspection workflow.

FocusControl is compatible with the C++, C#, VB, MATLAB, and LabView programming languages and comes with fully developed sample programs provided with the complete source code (Figure i-6 on page 18).

NOTE

Refer to the FocusControl *User's Manual* for a complete description.

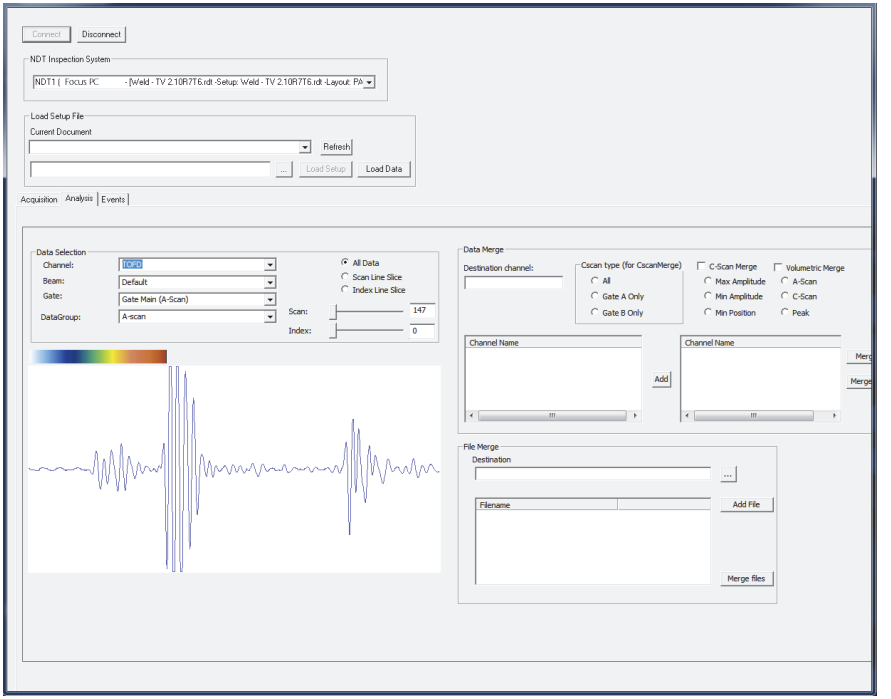

Figure i-6 Sample program provided with FocusControl

FocusData SDK

FocusData enables exporting of raw A-scan and C-scan data from FocusPC data files to Microsoft Excel, MATLAB, or any other external program. The exported data can then be used to perform processing algorithms and create customized data representations (Figure i-7 on page 19).

FocusData is compatible with the C++, C#, VB, MATLAB, and LabView programming languages and comes with fully developed sample programs provided with the complete source code (refer to the FocusData *User's Manual* for a complete description).

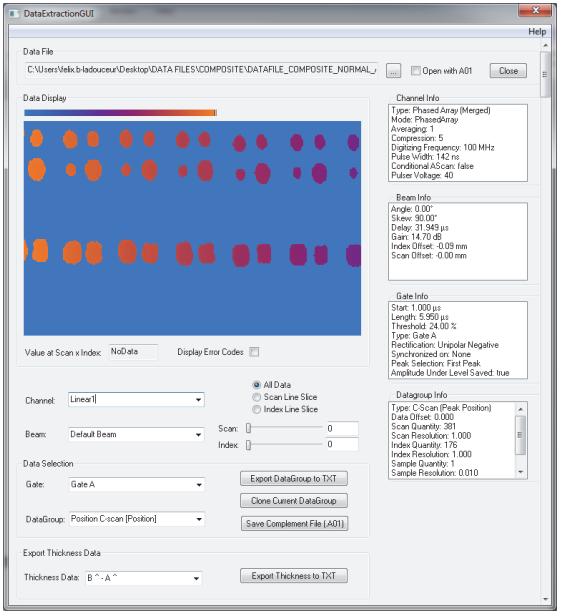

Figure i-7 Sample program provided with FocusData

1. Getting Started

This chapter contains information that enables you to quickly begin using FocusPC.

1.1 Minimum Computer Requirements

The minimum computer requirements for FocusPC software are as follows:

- CPU: Intel Core i7 or Xeon E3
- RAM memory: 16 GB (DDR3 or better)
- Data storage drive: SSD
- Network adaptor: Gigabit Ethernet card — dedicated to the acquisition instrument (for acquisition). The computer needs a second network adaptor if you want to simultaneously connect it to a local area network and to a data acquisition instrument.
- 1280 × 1024 or higher display adaptor and monitor resolution
- One USB port for the HASP security hardware key
- A keyboard and a pointing device
- Microsoft windows 10

IMPORTANT

You can install FocusPC on a drive other than the drive used for Windows. In that case, the FocusPC installer still requires 150 MB of the drive where Windows resides, to install the hardware security key driver, the Direct X updates, the Windows temporary installation, and the MFC (Microsoft Foundation Class) files.

NOTE

In this document, FocusPC screen captures were taken on a computer running Windows 10. The look of the screen captures could differ if you are using FocusPC on a computer running another operating system.

For most examples presented in this document, FocusPC was arbitrarily configured to use the metric measurement units (refer to the *FocusPC Advanced User's Manual* to find how to change measurement units).

1.2 Compatible Data Acquisition Instruments

FocusPC operates with Evident ultrasonic instruments to acquire data in Inspection mode and to analyze data files created with these instruments. Table 1 on page 22 provides the list of the compatible instruments.

Table 1 Evident data acquisition instruments compatible with FocusPC

Family	Models
FOCUS PX	FPX-UT4 [Q7750033]— 4-channel conventional UT
	FPX-1664PR [Q7750034] — 16:64 pulser receiver (PR) phased array
	FPX-16128PR [Q7750035] — 16:128 pulser receiver (PR) phased array
	FPX-32128PR [Q7750036] — 32:128 pulser receiver (PR) phased array

1.3 Connecting a FOCUS PX to a Computer and Setting Connection Parameters

Whenever you are connecting a FOCUS PX unit to a computer or switch, ensure that you use a category 5e or higher Ethernet cable.

To connect all cables on a FOCUS PX

- Connect all required cables to the FOCUS PX unit. The schematic below shows how to connect multiple units (Figure 1-1 on page 23). If you only use one unit, connect only the first one without a Sync Out cable.

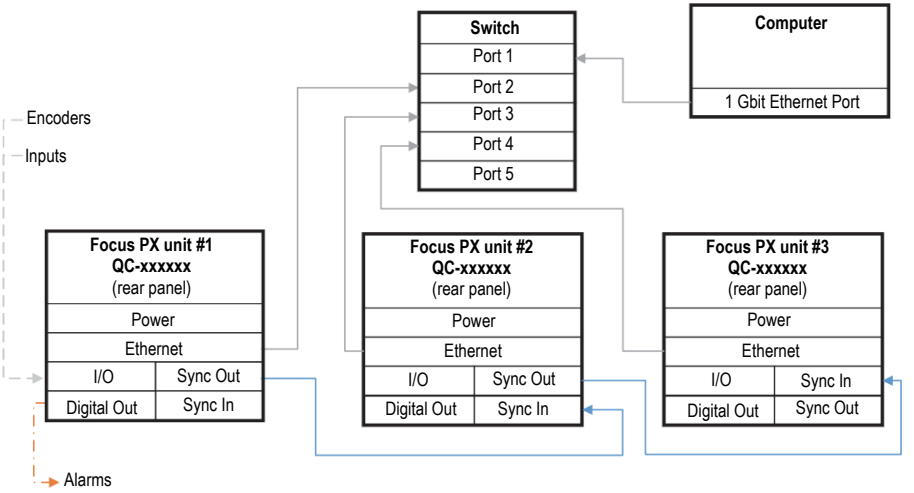

Figure 1-1 Multiple unit connection

NOTE

Whenever you use a switch, ensure that it supports a gigabit connection and jumbo packets.

For optimal performances, the switch should be configured to allow the jumbo packet. The MTU should be set at 9198.

To check your switch or computer setting

1. Open the **Command Prompt**.
2. Ping the FOCUS PX unit's IP address and add **-f -l 8972** at the end (Figure 1-2 on page 24).

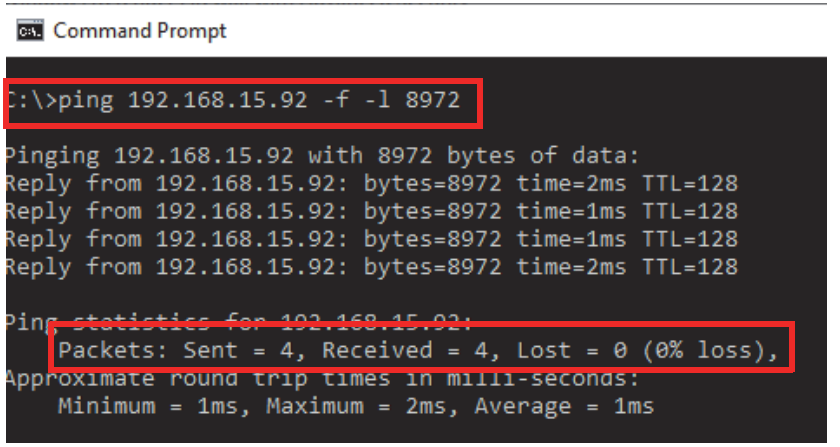

Figure 1-2 Command Prompt —jumbo packet

If your Ethernet card or switch are not jumbo packet compatible or not set properly, you will get a result as shown in Figure 1-3 on page 24.

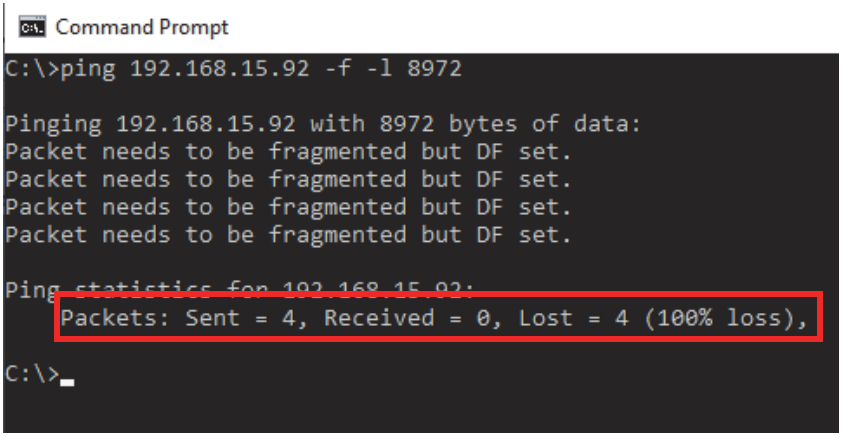

Figure 1-3 Command Prompt — no jumbo packet

You are now able to use the Configuration Tool to validate your connections.

1.4 Installing FocusPC

The installation of FocusPC is simple.

To install FocusPC

1. On the computer on which you want to install FocusPC, log on with a user account that has administrator rights.
2. Run the FocusPC installer program from the Evident distribution key or website.
3. Follow the on-screen FocusPC installer wizard steps.

   The wizard installs FocusPC, the Calculator, and the FOCUS PX Configuration Tool.
4. Disable the sleep mode on the computer to prevent a connection loss with the data acquisition unit:
   a) On the taskbar, click **Search**, type **Edit Power Plan**, select **Edit Power Plan**.
   b) In the dialog box **Edit Plan Settings**, set **Turn off the display** and **Put the computer to sleep** both to **Never** (Figure 1-4 on page 25).
   c) Click **Save changes**.

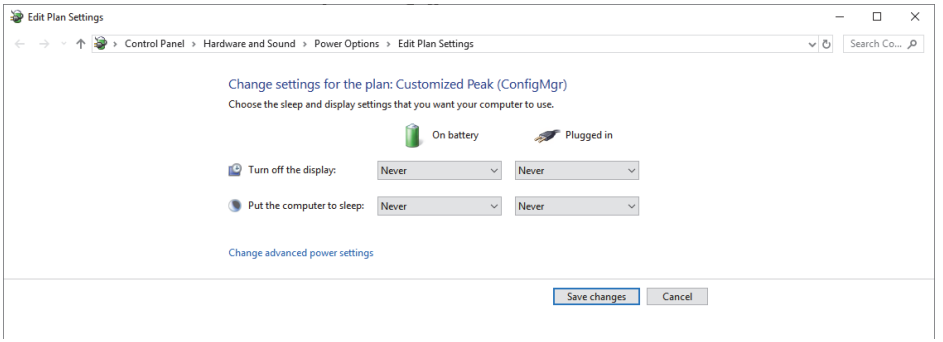

Figure 1-4 Edit Plan Settings dialog box

NOTE

If you use a third-party firewall on the computer running FocusPC, follow the instructions in "To add rules for a firewall" on page 30. The FocusPC installer configures the Windows firewall to allow communication between the FOCUS PX acquisition unit and the FocusPC and FOCUS PX Configuration Tool programs.

1.5 Using the FOCUS PX Configuration Tool

The FOCUS PX Configuration Tool is included with FocusPC and is used to configure the connection of your FOCUS PX acquisition unit and the network card.

To ensure that the Ethernet card settings are correct

1. Open the list of network connections in the **Control Panel**, and identify the connection used to connect to the FOCUS PX unit (Figure 1-5 on page 26).

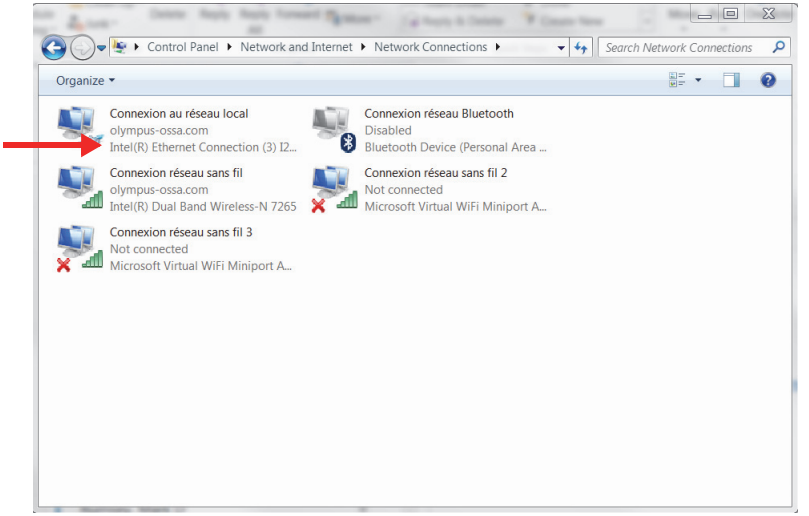

Figure 1-5 Network connections

2. Right-click the network connection used to connect to the FOCUS PX unit, and then click **Properties** (Figure 1-6 on page 27).

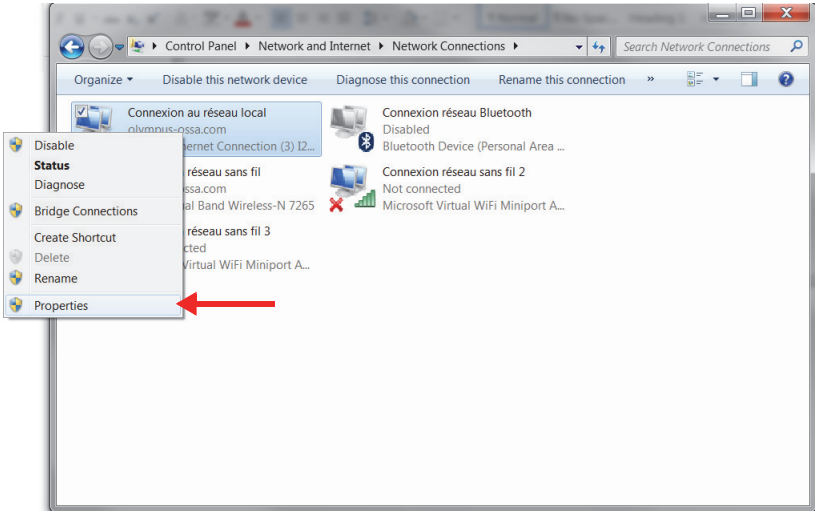

Figure 1-6 Selecting Properties

3. On the **Networking** tab, click **Configure** (Figure 1-7 on page 28).

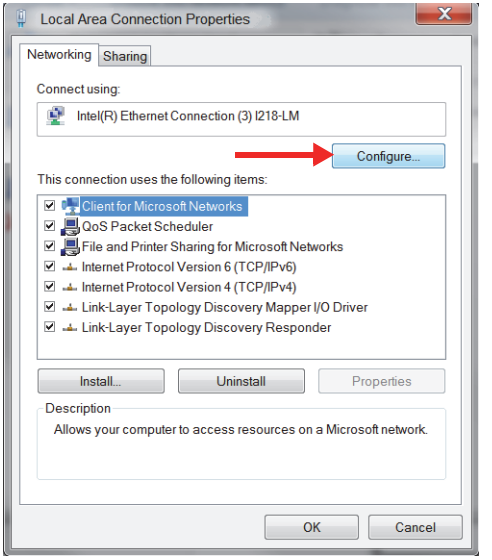

Figure 1-7 Selecting Configure

4. On the **Advanced** tab, in the **Property** list, select either **Jumbo Packet** or **Jumbo Frame** (Figure 1-8 on page 29).
5. In the **Value** list, select **9014 Bytes**.

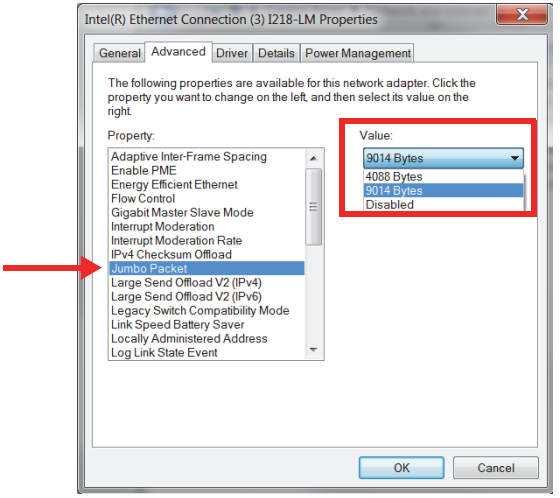

Figure 1-8 Settings on the Advanced tab

6. On the **Advanced** tab, select **Speed & Duplex**, and then select **1.0 Gbps Full Duplex** (Figure 1-9 on page 30).

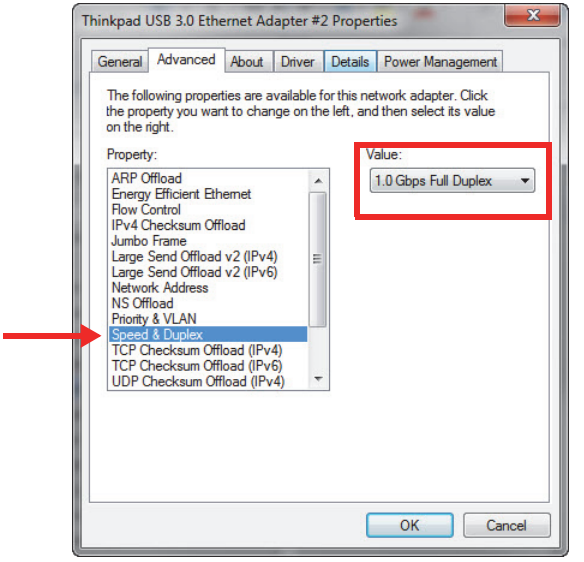

Figure 1-9 Speed & Duplex property

7. Click **OK**.

To add rules for a firewall

NOTE

It is recommended to turn off your computer's firewall and antivirus protection. If you do not turn off your firewall and antivirus protection, you must add rules to allow communication between your computer and the FOCUS PX unit. The procedure below shows an example of adding rules in Windows Defender. The procedure may differ if you have a different firewall and antivirus protection.

1. On the taskbar, click **Search**, locate your firewall program, then select **Advanced Settings**.
2. In the **Windows Defender Firewall with Advanced Security** dialog box, select **Inbound Rules**, and then select **New Rule** (Figure 1-10 on page 31).

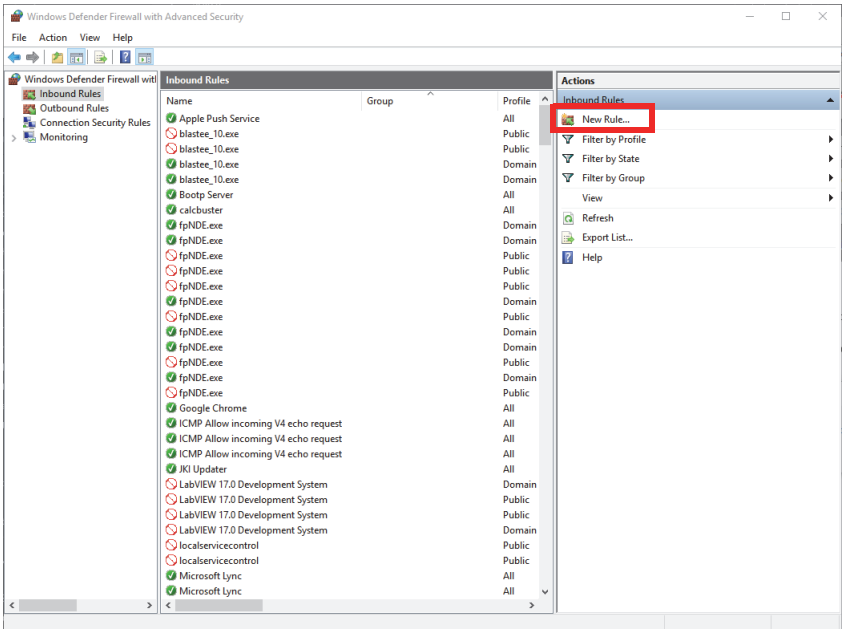

Figure 1-10 Windows Defender Firewall with Advanced Settings dialog box — Example

3. In the **New Inbound Rule Wizard** dialog box, select **Port** (Figure 1-11 on page 32).

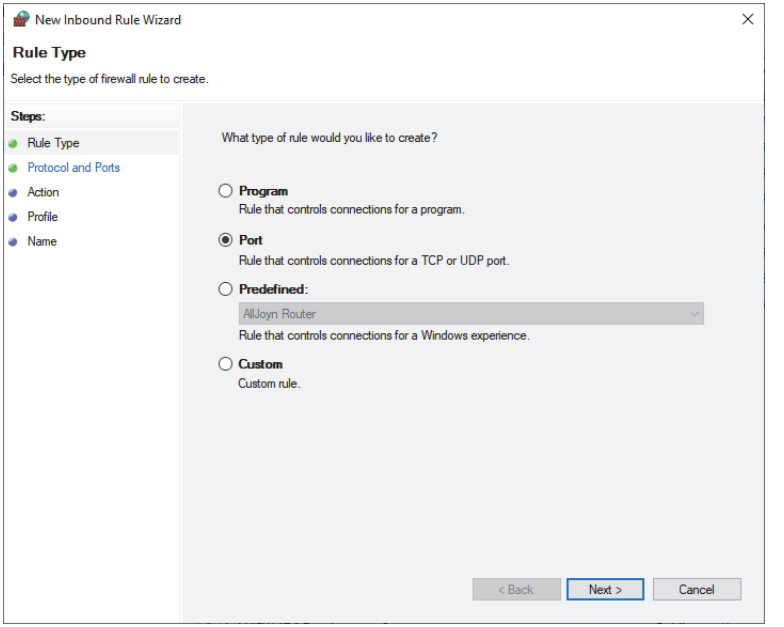

Figure 1-11 New Inbound Rule Wizard dialog box— Port

4. Click **Next**.
5. In the **New Inbound Rule Wizard** dialog box, select the protocols and ports to which the rule applies (Figure 1-12 on page 33).

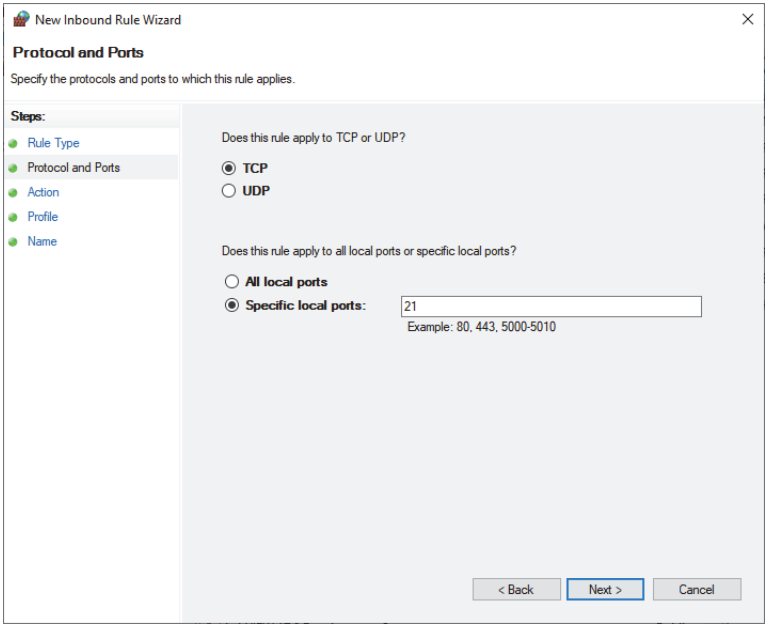

Figure 1-12 New Inbound Rule Wizard dialog box — Protocol and Ports

6. Click **Next**.
7. Configure the port with the parameters shown in Figure 1-13 on page 34, Figure 1-14 on page 34, and Figure 1-15 on page 35.

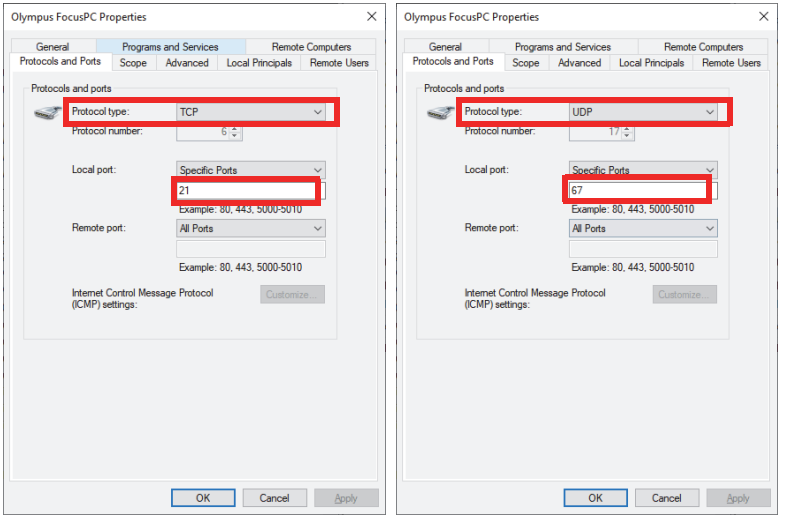

Figure 1-13 Protocol type — inbound rule TCP 21 and UDP 67

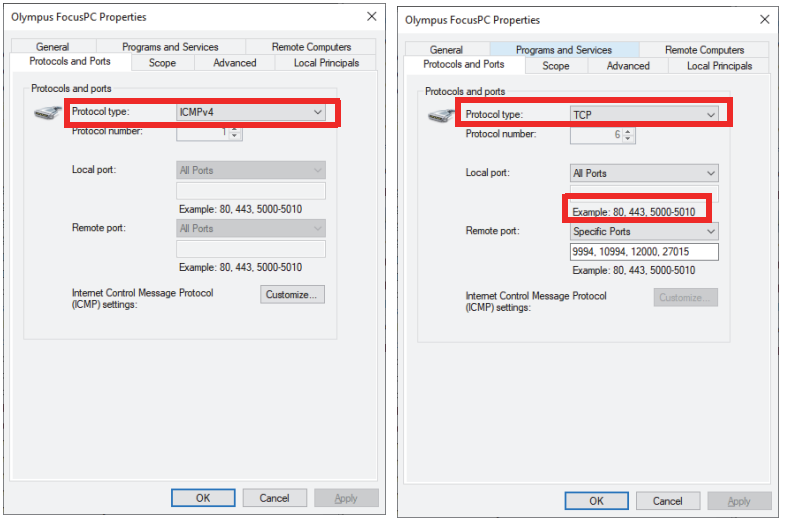

Figure 1-14 Protocol type — outbound rule ICMPv4 and TCP

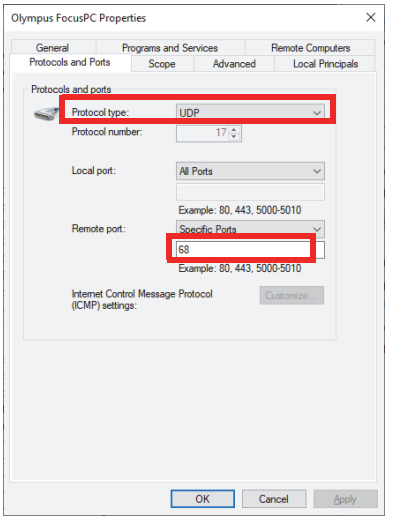

Figure 1-15 Protocol type — outbound rule UDP 68

8. Click **OK**.

To configure the FOCUS PX connection

1. Right-click the desktop icon ( ), and select **Run as administrator**.

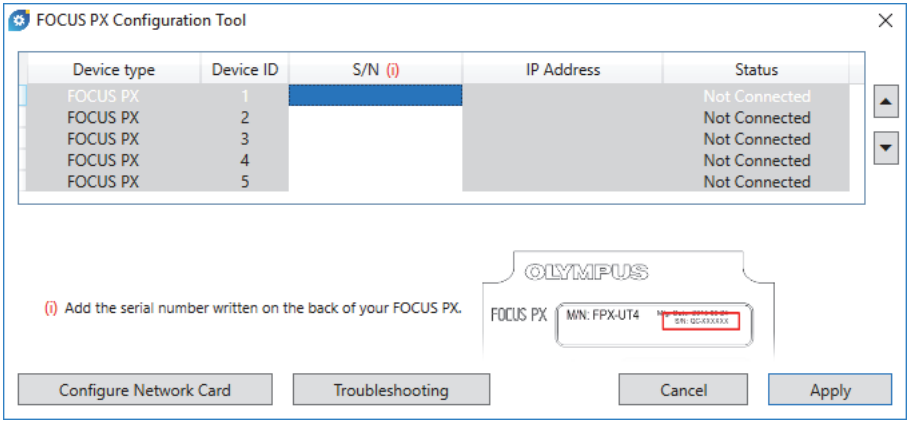

Figure 1-16 FOCUS PX Configuration Tool (no connected devices)

2. In the FOCUS PX Configuration Tool dialog box, click **Configure Network Card**.
3. In the **Network Configuration** dialog box, select the network card that will be used to communicate with the FOCUS PX unit, and then click **Configure** (Figure 1-17 on page 36).

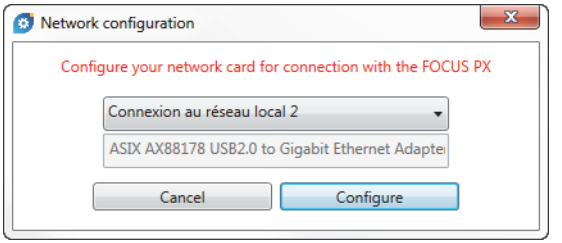

Figure 1-17 Network configuration dialog box

If the network connection is already being used for another device, a message appears to inform you that an alternative IP address will be assigned (Figure 1-18 on page 37).

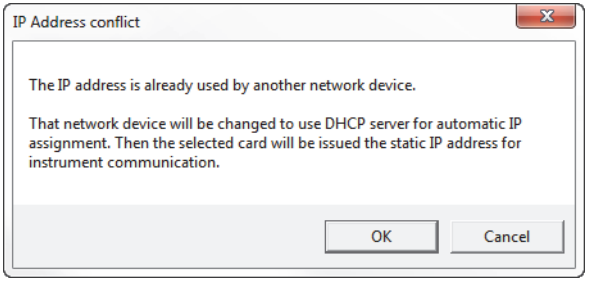

Figure 1-18 IP Address conflict dialog box

4. Turn on all FOCUS PX **units**.
5. In the FOCUS PX Configuration Tool dialog box, type the serial number of the first master FOCUS PX unit that is connected to the Ethernet card (Figure 1-19 on page 37).

   The serial number is located on the back of the FOCUS PX unit.

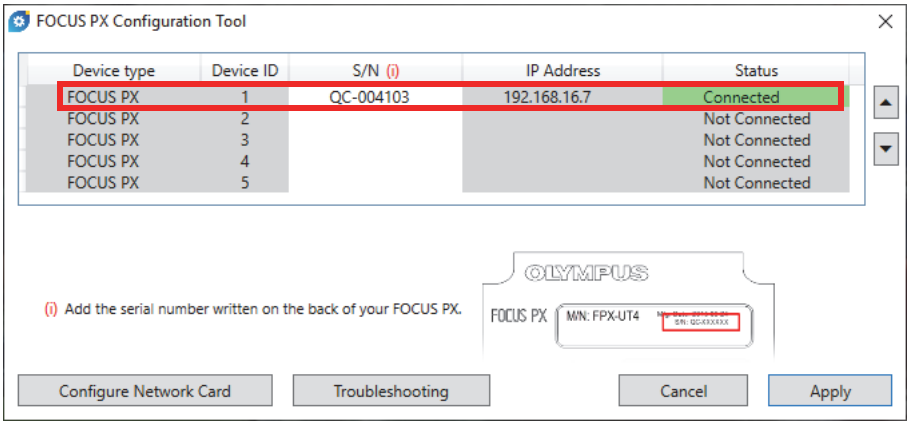

Figure 1-19 FOCUS PX Configuration Tool (1 device)

6. If you use more than one FOCUS PX unit, repeat the enter step of the serial number on the next entry (Figure 1-20 on page 38). Ensure that the order of the units is the same as the synchronization connection (see “Connecting a FOCUS PX to a Computer and Setting Connection Parameters” on page 22).

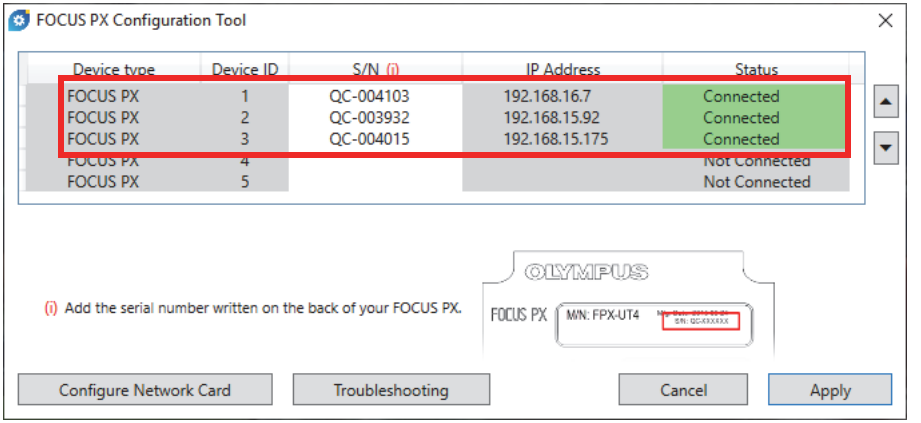

Figure 1-20 FOCUS PX Configuration Tool (3 devices)

7. Click **Apply**.

To troubleshoot the connection

- Click **Troubleshooting** to view a list of possible causes of connection problems, and follow the instructions provided (Figure 1-21 on page 39).

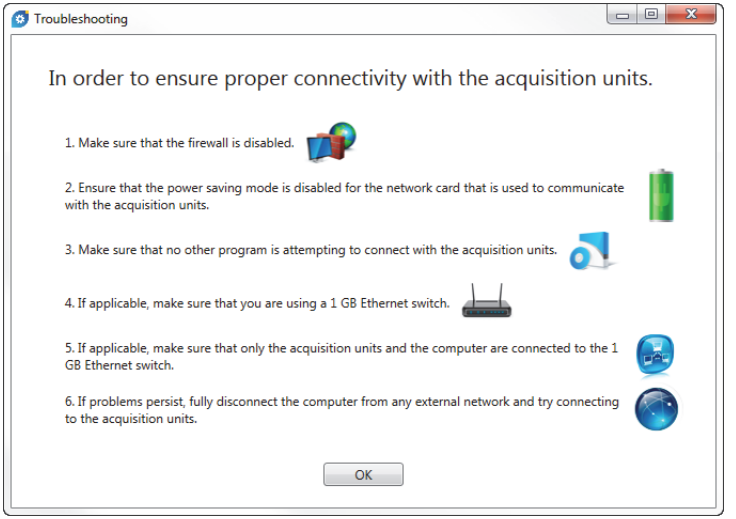

Figure 1-21 Troubleshooting dialog box example

1.6 FocusPC Editions

FocusPC is available in three editions:

Inspection

A full-featured mode providing all the inspection and analysis functions. With the FocusPC **Inspection** edition license, you can also choose to start the other FocusPC editions (see "Starting FocusPC" on page 42 for details).

Analysis

Provides all analysis functions but no inspection functions.

FocusPC Viewer

A free viewer that allows you to visualize FocusPC data files.

When you start up the software, you need to select which FocusPC edition you want to run (Figure 1-22 on page 40).

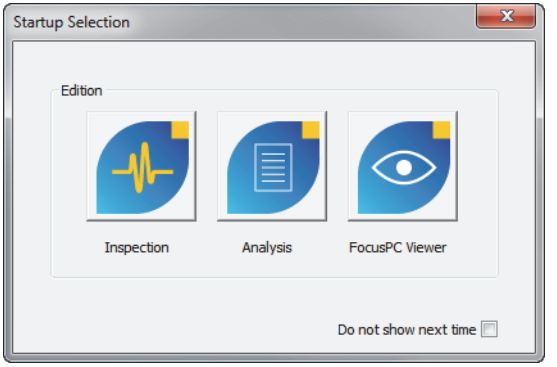

Figure 1-22 Startup Selection dialog box

The **About** FocusPC dialog box, accessed by selecting **Help > About**, reports which edition of FocusPC is currently running (Figure 1-23 on page 40).

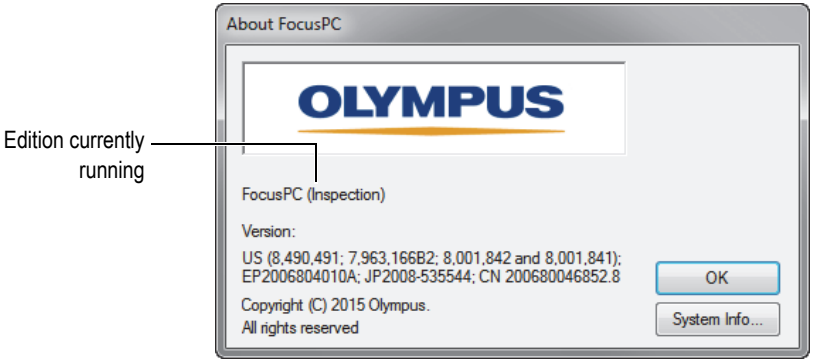

Figure 1-23 About FocusPC dialog box indicating the FocusPC edition

1.7 Security Hardware Key

To operate, FocusPC needs to detect a HASP security hardware key connected to the computer. The HASP security USB hardware key supplied with your FocusPC copy contains the authorization code needed to operate the FocusPC edition that you purchased.

Before starting FocusPC, connect the HASP hardware key (Figure 1-24 on page 41) to the USB port of your computer.

Figure 1-24 HASP security hardware key

When you start FocusPC with no security hardware key connected to the computer, FocusPC Viewer is the only enabled edition in the **Startup Selection** dialog box (Figure 1-25 on page 41).

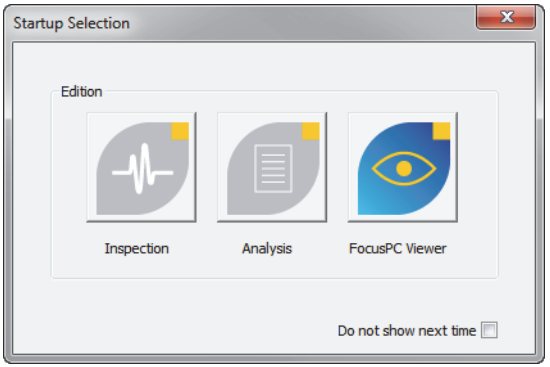

Figure 1-25 Startup Selection dialog box with no security hardware key

If you disconnect the security hardware key while FocusPC is running, the message shown in Figure 1-26 on page 42 appears 30 seconds later. After clicking **OK**, when needed, FocusPC proposes to save unsaved data, and then closes.

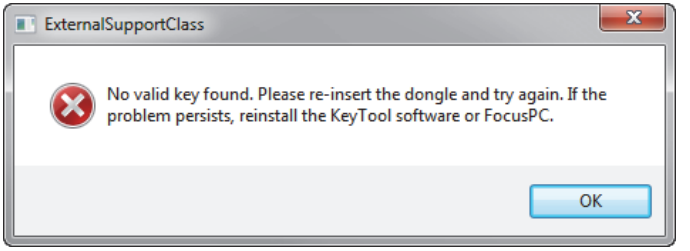

Figure 1-26 Missing hardware key message box

When you purchase both the Inspection and Analysis editions of FocusPC, two security hardware keys are delivered, one for each edition.

1.8 Starting FocusPC

FocusPC operates with or without a FOCUS PX. When you use FocusPC without an acquisition instrument, you can only perform analysis tasks on previously saved data files.

To start FocusPC

1. Connect the security hardware key to the appropriate port of the computer. FocusPC needs to detect the security hardware key to operate, regardless of whether or not it is connected to an acquisition instrument.
2. Turn on the computer and wait for Windows to complete its starting process. Do not start FocusPC yet.
3. Connect the data acquisition instrument to the appropriate network adaptor of the computer, and then start it (see "Connecting a FOCUS PX to a Computer and Setting Connection Parameters" on page 22 for a FOCUS PX).
4. Start FocusPC as follows:

   - Double-click the FocusPC icon on the Windows desktop.

     OR

     Click **Start > All Programs > Evident NDT >** FocusPC **n.nn** on the Windows taskbar.

5. In the **Startup Selection** dialog box that appears (Figure 1-27 on page 43), click the button associated with the desired FocusPC edition.

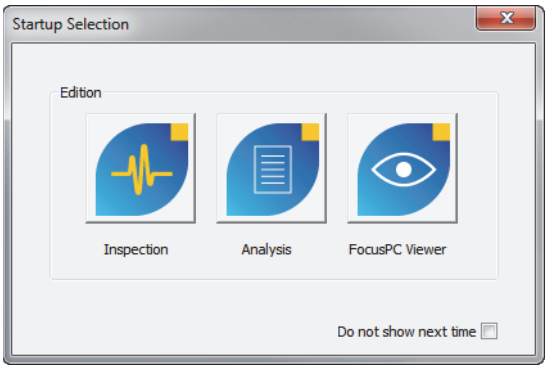

Figure 1-27 Startup Selection dialog box

TIP

If you do not want the **Startup Selection** dialog box to appear each time you start FocusPC, select the **Do not show next time** check box.

To reactivate the **Startup Selection** dialog box, select **File > Preferences > General Settings** tab in FocusPC, and then clear the **Startup Selection** check box under **Dialog Bypass**.

The FocusPC splash screen briefly appears, indicating that the application is starting up.

6. When you start the **Inspection** edition, the **Select Device Configuration** dialog box appears (Figure 1-28 on page 44). In the dialog box, do one of the following:
   - Select the acquisition instrument or instruments that you want to include in your configuration, and then click **OK**.

NOTE

With its multipod capability, FocusPC can acquire data from up to four FOCUS PX instruments in parallel (up to four active instruments, with an additional [fifth] passive instrument), offering up to a fourfold increase in acquisition speed.

OR

When your computer is not connected to an acquisition instrument, click **Work Offline** to use FocusPC only in Analysis mode. In this case, Setup mode and Inspection mode will be unavailable.

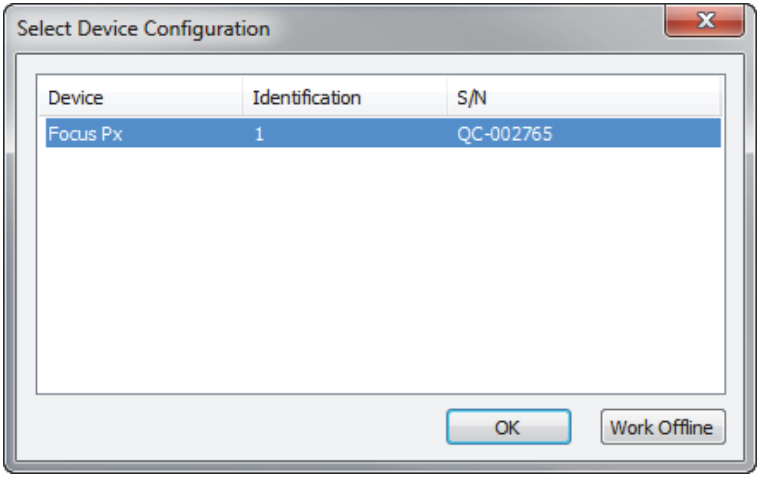

Figure 1-28 Example of the Select Device Configuration dialog box

NOTE

The list in the **Select Device Configuration** dialog box is empty when FocusPC fails to detect any hardware devices either because supported acquisition instruments are not connected, are not turned on, or are not correctly installed. Refer to the *FocusPC Advanced User's Manual* for troubleshooting information.

7. In the **Configuration Selection** dialog box that appears (Figure 1-29 on page 45), select one of the following setup loading options, and then click **OK**.

   Open the last configuration

   Select this option to load the last configuration used, whose name is indicated in the box below. By default, the box indicates the name of the default configuration (Default_PA.fps, Default_UT.fps, and more).

   Open an existing configuration

   Select this option to access the **Open** dialog box. You can use this dialog box to browse through the folders and choose a configuration file (with the file name extension .fps).

   Create a new configuration

   Select this option to start a new configuration from a default configuration.

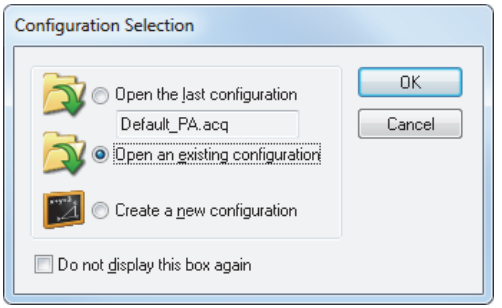

Figure 1-29 Configuration Selection dialog box

NOTE

A configuration file (.fps) is a complete description of the FocusPC workspace. The file includes the acquisition instrument hardware setup and the FocusPC layout environment.

If you click **Cancel**, the default configuration loads (Default_PA.fps for a phased array instrument or Default_UT.fps for a UT conventional instrument).

After the selected setup is loaded, the FocusPC window appears.

2. User Interface

This chapter details FocusPC user interface elements.

2.1 FocusPC User Interface and Software Principles

FocusPC provides features needed to perform nondestructive inspections based on ultrasonic technology. It combines setup, inspection, and analysis functions in one software package. FocusPC can also be used in a stand-alone mode to analyze previously acquired data.

The FocusPC user interface (Figure 2-1 on page 48) provides toolbars and menus for quick access to main commands. Using FocusPC, you can conveniently present data imaging in multiple simultaneous views, such as in the example in Figure 2-1 on page 48.

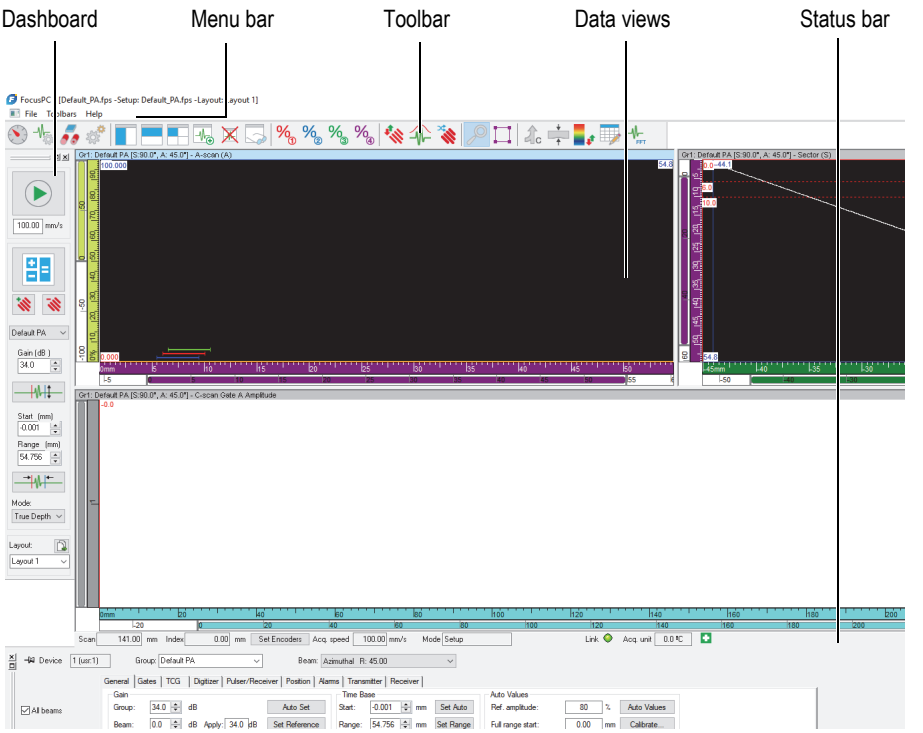

Figure 2-1 FocusPC user interface example

Data views

A data view is a visual representation of an inspection. You can create several types of views and display them simultaneously to visualize different aspects of your inspection.

Splitting data views

You can subdivide a data view into multiple sections. The split sections have the advantage of being easily resized while maintaining the “tiled” nature of the various views.

The data views can be user defined to contain any of the possible view types generated by FocusPC. For further information concerning the different types of views, see “Data View Types” on page 74.

In FocusPC, the data views also offer flexibility for the location of readings: cursor positions, statistics, scale settings, etc. These fields can be dynamically placed and customized within any view. For further information concerning the readings, see “Working with the Readings” on page 135.

Layout

A layout is a complete set of display-related settings. You can save and load a layout to quickly return to a desired view configuration. Layout configurations are included in data files so that recorded data can be viewed through the original layouts that existed at data-recording time, or through the current system layouts.

Template layouts are also provided as a reference for the most common inspection types. A menu on the Dashboard provides quick access to existing template layouts installed in FocusPC (see “Working with Layouts” on page 132 for more information on using layouts).

Setup

A setup file is a complete set of FocusPC settings that an operator can access while using the FocusPC interface. Setup files may contain one or more layouts, and they can be saved and restored on demand.

Normally, a setup represents a procedure for a specific application that is to be performed with the equipment.

2.2 Component Toolbars

The FocusPC toolbars at the top of the main window contain buttons to initiate commands or to access dialog boxes. See Figure 2-2 on page 49 and Table 2 on page 50 for descriptions of the components available in the toolbars. In the menu under **Toolbars**, you can show or hide the **Advanced Weld** and **Advanced Aero** toolbars by selecting or deselecting them in the menu.

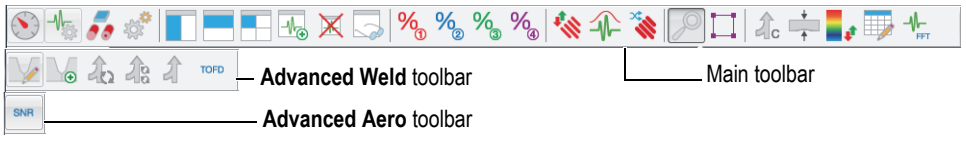

Figure 2-2 Component toolbars

Table 2 Toolbar buttons

Icon	Component	Description
Main toolbar buttons		
	Dashboard	Opens and closes the Dashboard pane, which is used to manage groups and inspection sequences
	UT settings	Opens the **UT Settings** dialog box, which contains the ultrasonic setup parameters
	Part and material	Opens the **Part Definition** dialog box, in which you define the geometry of flat or cylindrical parts
	Scan settings	Opens the **Scan and Mechanical Settings** dialog box, which is used to define the scan and settings for the mechanical scanning system
	Split view vertically	Divides the active view into two views with the same vertical dimension
	Split view horizontally	Divides the active view into two views with the same horizontal dimension
	Split view in four	Divides the active view into four views with the same horizontal and vertical dimensions
	Add view content	Opens the **Contents** dialog box, used to select the data view types to be displayed in the active pane
	Delete view	Deletes the active view
	View properties	Opens the **View Properties** dialog box, used to configure the parameters of the active view
	Readings 1	Toggles the display of information group 1 in the active view (by default, readings related to reference cursors)
	Readings 2	Toggles the display of information group 2 in the active view (by default, readings related to measurement cursors)

Table 2 Toolbar buttons *(continued)*

Icon	Component	Description
	Readings 3	Toggles the display of information group 3 in the active view (by default, readings related to reference and measurement cursors)
	Readings 4	Toggles the display of information group 4 in the active view (by default, readings related to the Zone tool)
	PA calibration	Calibrates all phased array beams
	Signal envelope	Toggles the activation of the Envelope mode for the A-scan view
	Firing sequencer	Modifies the order in which the ultrasonic beams are fired
	Zoom tool	Select and zoom in a specific region on a view
	Zone tool	Select a region on a top, side, end, or C-scan view by clicking and dragging **Tip**: When the Zone tool is not selected, press and hold the CTRL key, and then click and drag on a view to perform the same task.
	C-scan merge	Opens the **C-Scan Merge** dialog box, used to perform a C-scan merge of recorded data in Analysis mode
	Thickness C-scan	Opens the **Create Thickness C-Scan** dialog box, which can be used to create thickness C-scan data by performing subtractions on data originating from two gates
	Soft gain tool	Opens the **Gain Information** dialog box, used to set the software gain and dynamically change color palette maximum and minimum values
	Indication table	Opens the **Indication Table** dialog box, used to manage indication information and create reports

Table 2 Toolbar buttons *(continued)*

Icon	Component	Description
	Fast Fourier transform	Opens the **Fast Fourier Transforms** dialog box, used to calculate values related to the fast Fourier transform (FFT)
Advanced Weld toolbar buttons		
	Edit weld	Opens the **Edit Overlays** dialog box, in which you can rename, relocate, or delete a component
	Add weld	Opens the **Predefined Weld** dialog box, in which you select a weld type and define its geometry
	Automatic volumetric merge	Performs a volumetric merge of all focal laws for all groups using the default parameters
	Automatic volumetric merge by group	Performs a volumetric merge of all focal laws for each corresponding group using the default parameters
	Volumetric merge	Opens the **Volumetric Merge** dialog box, used to perform a volumetric merge of recorded data in Analysis mode
	TOFD Manager	Opens the **TOFD Manager** dialog box, used to analyze time-of-flight diffraction inspection data
Advanced Aero toolbar button		
	SNR analysis	Opens the **SNR Analysis Utility** dialog box, used to compute the signal-to-noise ratio

2.3 Dashboard Dialog Box

The Dashboard is where you pilot the operations in FocusPC. The Dashboard contains the mode, group, scan, and layout parameters that you need to define before performing an inspection (Figure 2-3 on page 53).

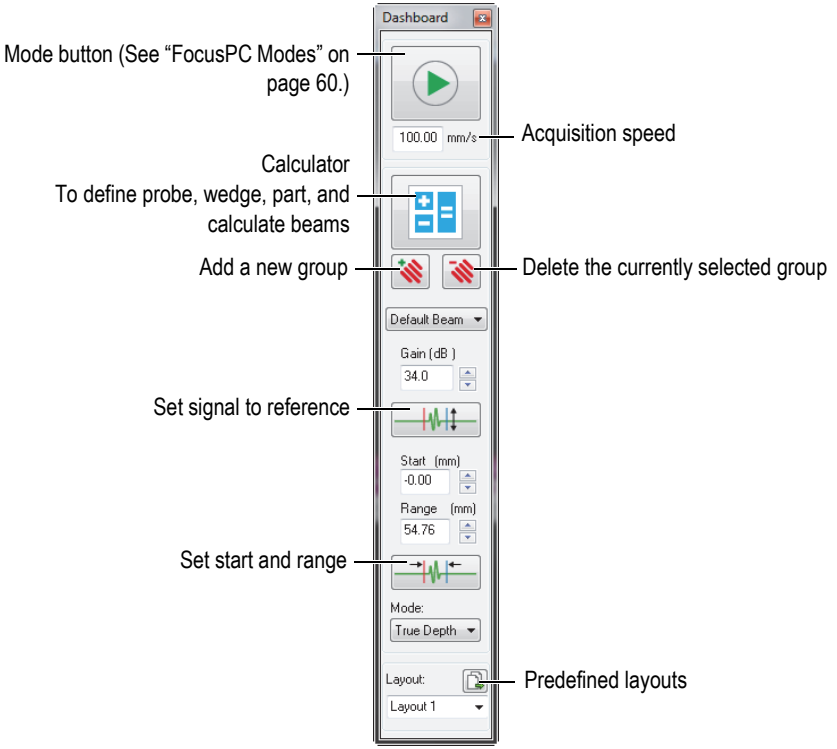

Figure 2-3 Components of the Dashboard dialog box

2.4 Document Windows

FocusPC allows you to open one or more document windows at a time: a separate window for each file that is opened. However, only one setup can be open at a time. You can display one or more data views at a time in each window (Figure 2-4 on page 54).

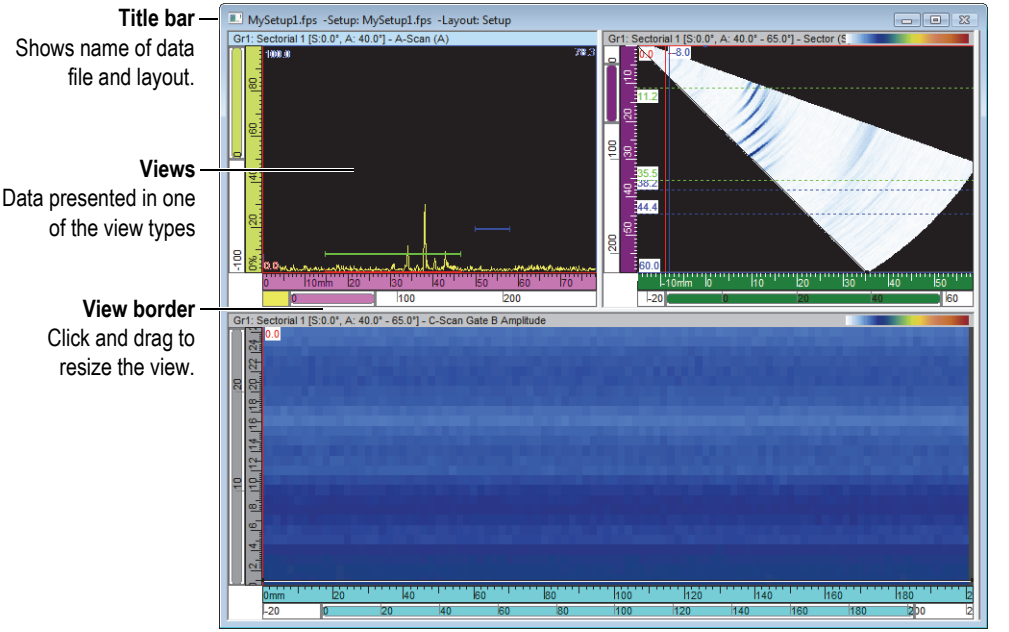

Figure 2-4 Example of a document window containing three views

You can cascade or manually tile multiple windows. You also can add, remove, or empty views in a window, using the toolbar. Two or more views appear side by side, never overlapping. You activate any view by clicking on it.

2.5 Layouts

In FocusPC, a layout is an organization of two or more views appearing in the window. Layouts offer extensive flexibility in how you present your inspection data.

FocusPC offers a set of ten layouts that are available on the Dashboard for quick selection (Figure 2-5 on page 55). You can also select one of the layouts on the **Layout** menu. A set of ten layouts is saved in an .rst file.

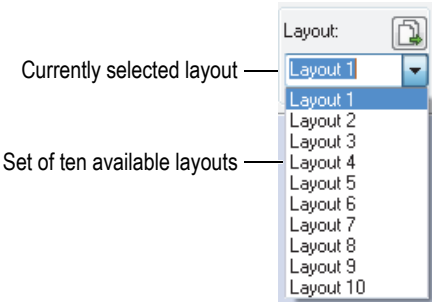

Figure 2-5 Set of ten layouts

2.6 UT Settings Dialog Box

You can click the UT Settings button ( ) on the component toolbar to toggle the visibility of the **UT Settings** dialog box. The **UT Settings** dialog box contains eight basic tabs: **General**, **Gate**, **TCG**, **Digitizer**, **Pulser/Receiver**, **Position**, **Alarms**, **Transmitter**, and **Receiver** (Figure 2-6 on page 55). For more details on the different tabs of the **UT Settings** dialog box, refer to the *FocusPC Advanced User's Manual*.

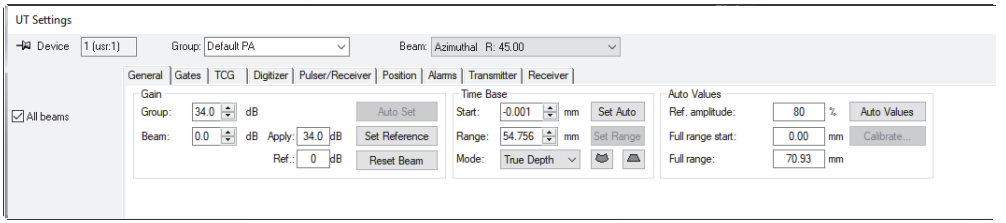

Figure 2-6 UT Settings dialog box

2.7 Scan and Mechanical Settings Dialog Box

Clicking the Scan Settings button ( ) on the component toolbar toggles the visibility of the **Scan and Mechanical Settings** dialog box, which contains four basic tabs: **Scan**, **I/O**, **Encoders**, and **Data** (Figure 2-7 on page 56). For more details on the different tabs of the **Scan and Mechanical Settings** dialog box, refer to the *FocusPC Advanced User's Manual*.

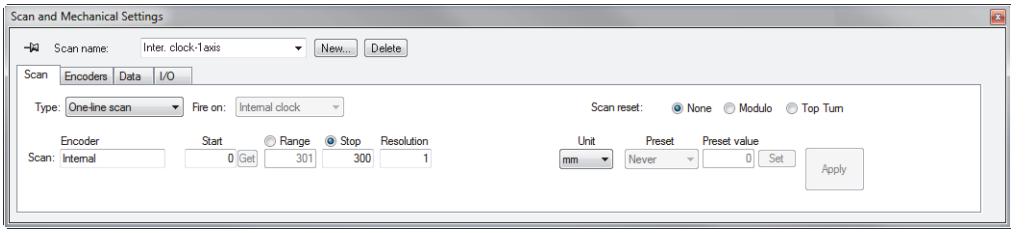

Figure 2-7 Scan and Mechanical Settings dialog box

2.8 View Properties Dialog Box

Clicking the View Properties button ( ) on the component toolbar toggles the visibility of the **View Properties** dialog box. The **Information**, **Display**, **Palette**, **Data Source**, and **Units** tabs are available in the **View Properties** dialog box, depending on the data type contained in the active view. For more details on the different tabs of the **View Properties** dialog box, refer to the *FocusPC Advanced User's Manual*.

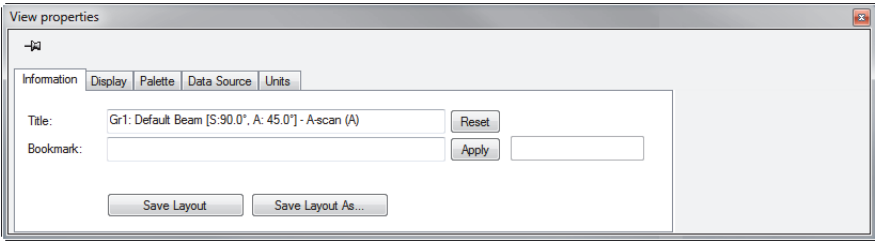

Figure 2-8 View Properties dialog box

2.9 Docking Dialog Boxes

FocusPC allows you to dock the main dialog boxes on a window border. A docking dialog box aligns itself with an edge of the window. By dragging its title bar, you can move the docking dialog box anywhere on the screen as a floating dialog box. Inversely, you can drag and dock the floating dialog box to one of the window edges (Figure 2-9 on page 57).

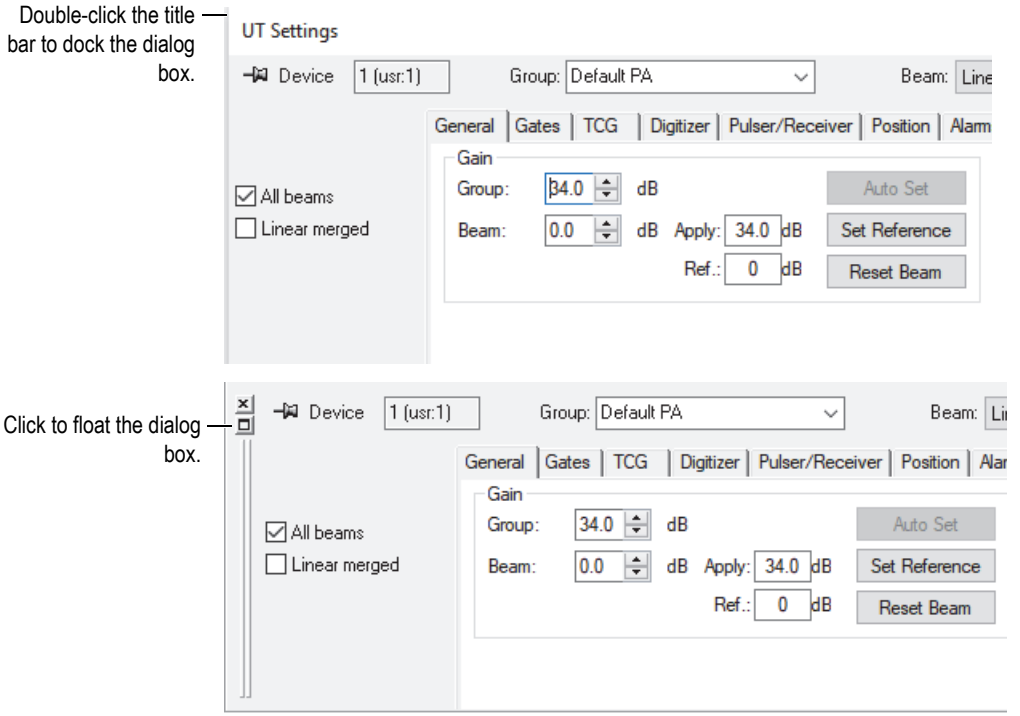

Figure 2-9 Floating (top) and docking (bottom) of a dialog box

Using the *thumbtack* function, you can specify if the dialog box remains displayed or not when you open other docking dialog boxes. For this purpose, you can click the thumbtack icon, located in the upper-left corner of the dialog box, to toggle between the two following options:

Tacked option icon ( )

The dialog box remains open when you open other docking dialog boxes.

Untacked option icon ( )

The dialog box closes when you open other docking dialog boxes.

3. Concepts and Operational Mode

The FocusPC user interface shown in Figure 3-1 on page 59 provides toolbars, dockable dialog boxes, a data display, and a status bar.

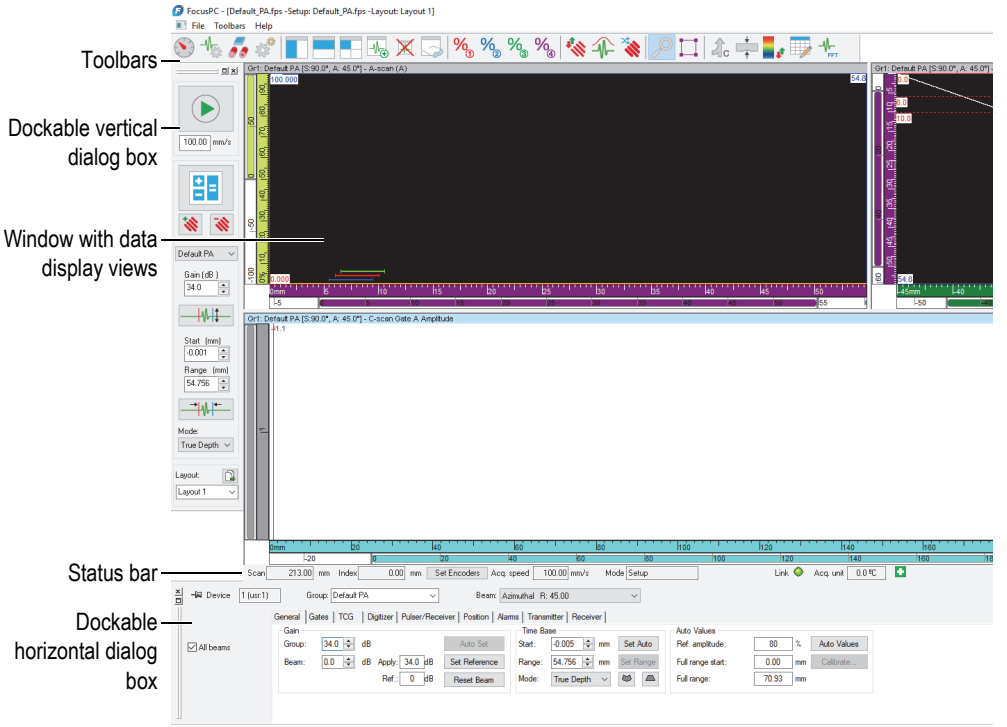

Figure 3-1 Main elements of the FocusPC user interface

3.1 FocusPC Modes

FocusPC has three modes:

Setup

Mode in which you set up the various hardware and software parameters (ultrasonic, scan, and window layout settings). FocusPC starts in Setup mode when it is connected to an acquisition instrument.

Inspection

Mode in which you perform data acquisition. Inspection mode is available only when FocusPC is connected to an acquisition instrument.

Analysis

Mode in which you carry out analysis and produce reports for recorded data. FocusPC starts in Analysis mode when it is not connected to an acquisition instrument.

To go from one mode to the another, on the Dashboard, click the mode button (Figure 3-2 on page 61). The mode button changes depending on the current mode.

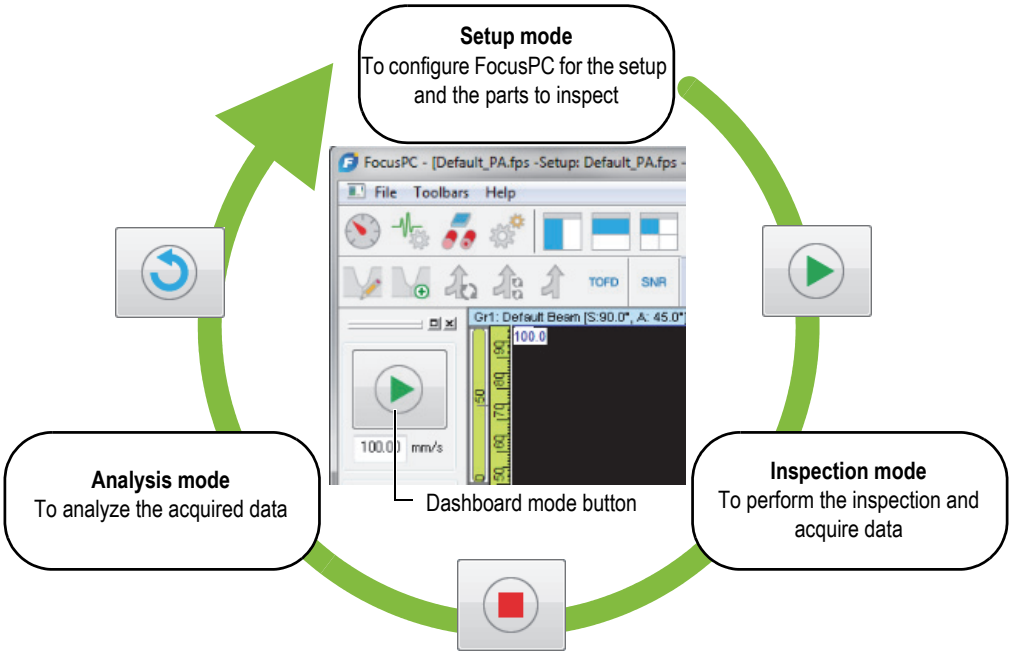

Figure 3-2 Switching between modes

The status bar, which remains visible below the views, includes a **Mode** parameter that indicates the current mode (Figure 3-3 on page 61).

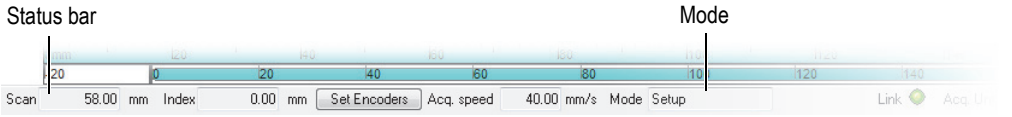

Figure 3-3 Mode indicated in the status bar

3.2 Groups

In FocusPC, a *group* is a defined configuration of parameters to generate one or more ultrasonic beams using a conventional or phased array probe. A group can pulse and receive on the same probe, or you can use two different probes, one to pulse, and the other to receive, and a probe can be used by more than one group.

Assembling different beams in one group allows you to set the same parameters for all the beams at one time. This also allows you to display images built from all beams (such as a sectorial scan). Depending on the application, it might be helpful to use different settings for different beams (for example, different band-pass filters), justifying the creation of one group per beam.

You can create, delete, select, and configure groups on the Dashboard (Figure 3-4 on page 62).

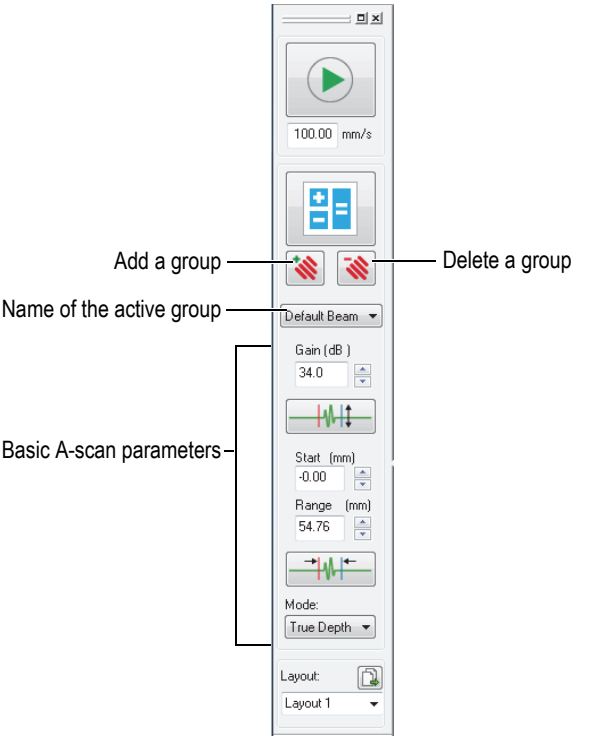

Figure 3-4 Group area in the Dashboard

For example, you can create a first phased array group to generate a linear scan, a second group to generate a sectorial scan, and then display them concurrently in a layout (Figure 3-5 on page 63).

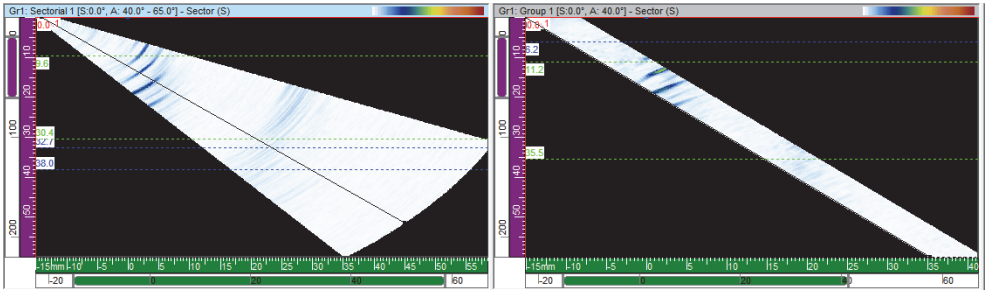

Figure 3-5 Example of two scans from two different groups

3.3 Calculator

The Calculator is an Evident software that comes with FocusPC. You start the Calculator on the Dashboard by clicking the Calculator button ( ). From FocusPC, use the Calculator to specify the probe and wedge used in the inspection, the geometry and material of the inspected part, and the beam configuration. The Calculator calculates the beams and returns the information to FocusPC.

NOTE

Refer to the *FocusPC Advanced User's Manual* for more details.

3.4 Scans

In FocusPC, you can configure scan parameters and save them as a named scan. FocusPC comes with useful predefined scans.

You can edit, delete, or create a scan configuration (including predefined scans) using the **Scan and Mechanical Settings** dialog box (Figure 3-6 on page 64). The scan configurations are saved in the hardware setup (.fps) file.

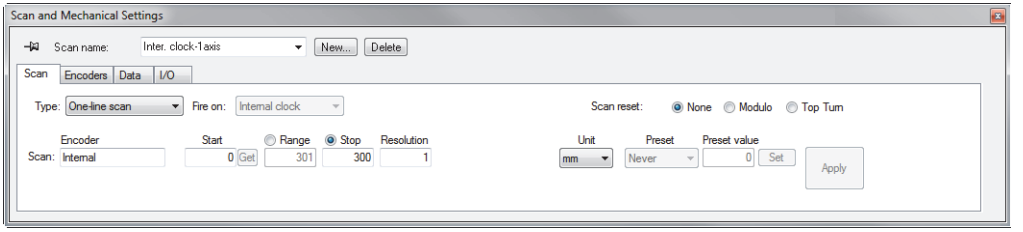

Figure 3-6 Scan tab of the Scan and Mechanical Settings dialog box

The following predefined scans are available:

Free running

Scan where data is acquired at the rate specified under **PRF** on the **Digitizer** tab of the **UT Settings** dialog box. The data is recorded at only one position, at the origin of the scan and index axes.

Encoded - 1 axis

Scan using one position encoder to determine the position during the acquisition along a linear path. The data is recorded at every interval (corresponding to the resolution setting) along the path from the start position to the end position of the scan axis.

Encoded - 2 axis

Scan using two position encoders to determine the position during the acquisition on a bidimensional surface scan. The data is recorded at every interval (corresponding to the resolution setting) along the path from the start position to the end position of both the scan and index axes.

Inter. clock - 1 axis

Scan using the internal clock (PRF) to determine the position during the acquisition along a linear path. The data is recorded at every interval (corresponding to the resolution setting) along the path from the start position to the end position of the scan axis.

Inter. clock - 2 axis

Scan using the internal clock (PRF) to determine the position during the acquisition on a bidimensional surface scan. The data is recorded at every interval (corresponding to the resolution setting) along the path from the start position to the end position of both the scan and index axes.

TIP

When you modify or delete predefined scans, you can restore them by opening a default hardware setup (.fps) file.

3.5 Probe Orientation Conventions

This section describes the conventions used in FocusPC for the probe and the wedge orientations relative to the axes.

The probes and wedges are illustrated schematically as shown in Figure 3-7 on page 65. The probe element number of a phased array generally increases from the back to the front of the probe/wedge assembly.

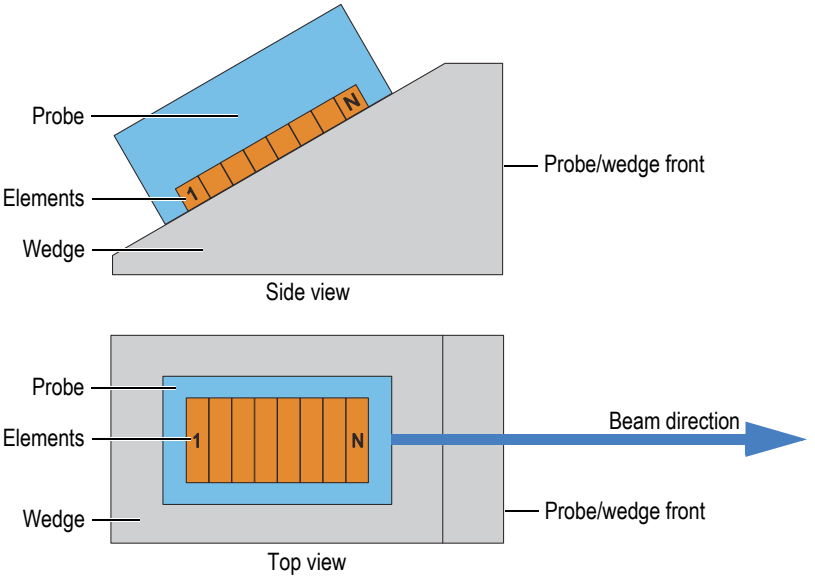

Figure 3-7 Example of illustration of a probe and a wedge

NOTE

In applications where the probe connector or wire is physically interfering with other inspection setup components, you can mount the probe in a reverse position on the wedge. To notify FocusPC about this, in the Calculator, select the **Reverse primary axis** check box under the **Probe** area. The check box is automatically selected when you select a reversed wedge model.

The probe skew is defined as the angle between the primary axis of the probe and the scan axis. The skew has a value of 0° when the beam direction points parallel to the scan axis in the positive direction. The skew angle increases clockwise.

In the example shown in Figure 3-8 on page 67, the angle beam probe is moving on the inspected part along the scan axis following a raster scan pattern. The beam direction is parallel to the scan axis. Consequently, the probe skew is equal to 0°.

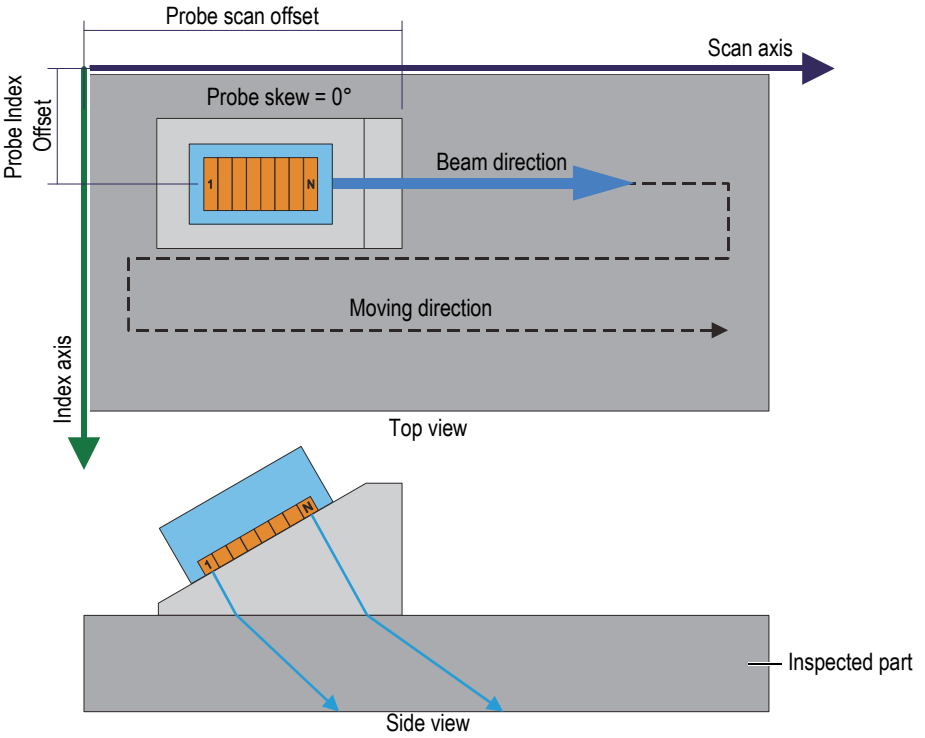

Figure 3-8 Raster scan plate inspection with 0° probe skew

In the example shown in Figure 3-9 on page 68, the probe is moving on the inspected part along the scan axis. The beam direction is along the ultrasonic axis but the beam electronic scanning direction is parallel to the index axis. Consequently, the probe skew is equal to 90°.

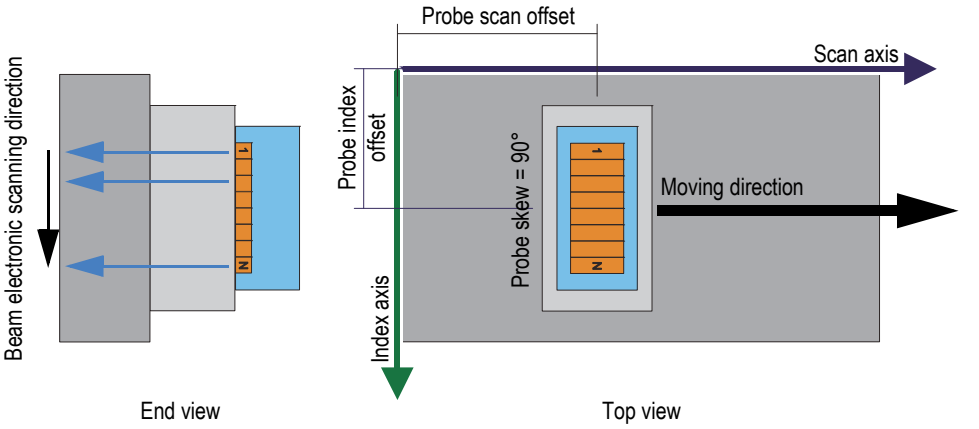

Figure 3-9 Plate inspection with 90° probe skew

In the example shown in Figure 3-10 on page 68, the angle beam probe is moving on the inspected part along the scan axis and the beam direction is parallel to the scan axis. Consequently, the probe skew is equal to 0°.

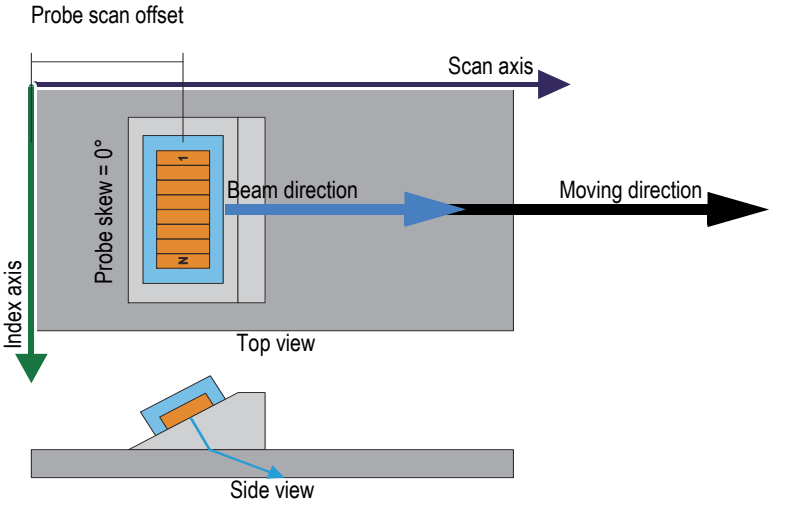

Figure 3-10 Rivet inspection with 0° probe skew

In the example shown in Figure 3-11 on page 69, a mechanical scanner is holding two angle beam PA probes and two angle beam UT probes. The four angle beam probes are moving on the inspected part along the scan axis and the along the weld. The direction of the beam is parallel to the index axis. Consequently, the probe skews are equal to 90° or to 270°.

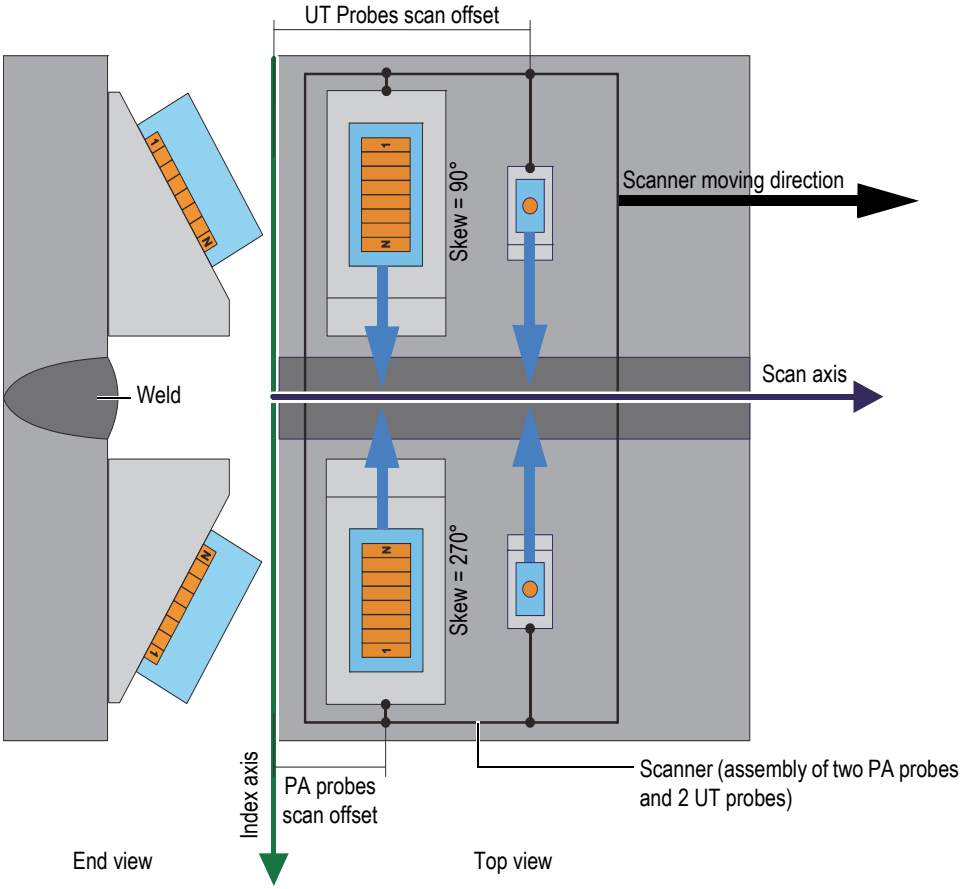

Figure 3-11 Weld inspection using a scanner with 90° and 270° probe skews

In the example shown in Figure 3-12 on page 70, the angle beam probes are moving on the inspected disc or wheel circumference along the scan axis. The beam direction is parallel to the scan axis. Consequently, the probe skews are equal to 0° or to 180°.

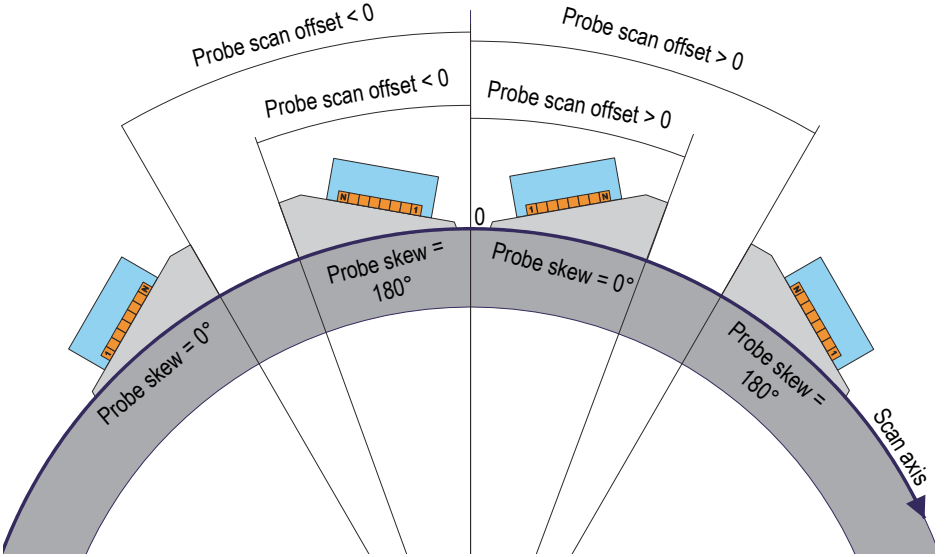

Figure 3-12 Disc or wheel inspection with 0° and 180° probe skews

In the example shown in Figure 3-13 on page 71, two facing angle beam PA probes are moving on the inspected tube along the scan axis along the weld. The scan axis, represented by the symbol ⊗ in Figure 3-13 on page 71, is oriented in the third dimension perpendicular to the plan of the figure and extends in a direction away from the reader's point of view. The beam directions are parallel to the index axis. Consequently, the probe skews are equal to 90° and 270°.

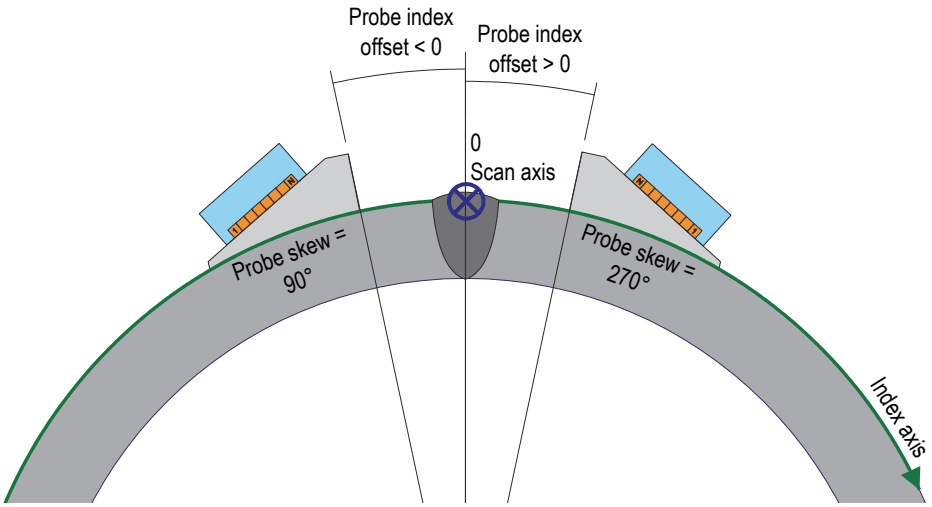

Figure 3-13 Tube weld inspection with 90° and 270° probe skews

3.6 Layouts

In FocusPC, a layout is an organization of two or more views appearing in the window. Layouts offer extensive flexibility in how you present your inspection data.

FocusPC offers a set of ten layouts that are available on the Dashboard for quick selection (Figure 3-14 on page 71). You can also select one of the layouts on the **Layout** menu. A set of ten layouts is saved in an .rst file.

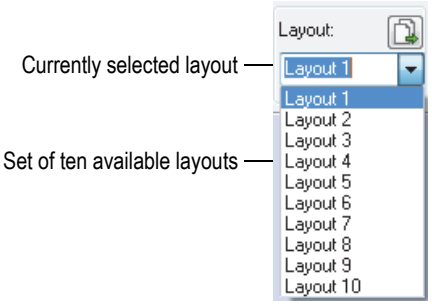

Figure 3-14 Set of ten layouts

The predefined layouts button of the Dashboard allows you to quickly load a set of predefined layouts adapted to an application (Figure 3-15 on page 72).

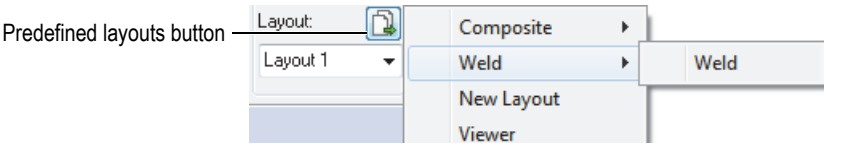

Figure 3-15 Selecting predefined layouts

3.7 Views

Several types of views can be used to display the data for the current document. Figure 3-16 on page 72 contains an example of an A-scan data view.

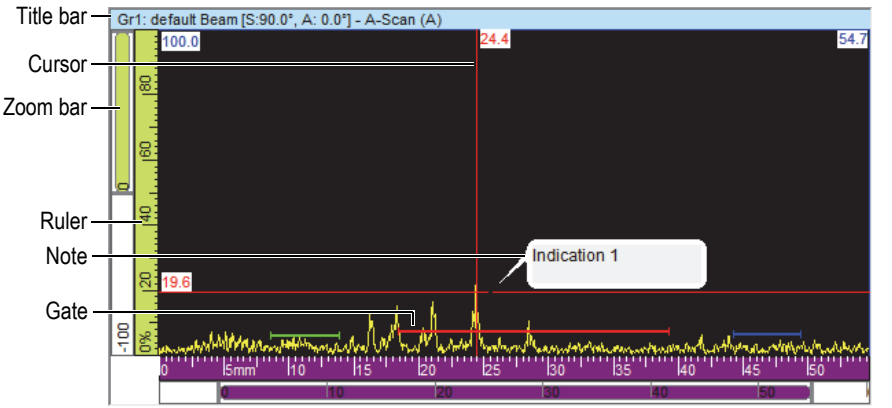

Figure 3-16 Example of an active A-scan view

A view contains the following elements:

Title bar

The title bar of the active view is highlighted with a light-blue background as shown in Figure 3-17 on page 73.

Figure 3-17 Example of the title bar of an active view

The title bar contains information describing the data in the view:

<Group Number><Group Name>[S: <Skew Angle>, A: <Beam Angles>]

where:

<Group Number>: Sequential number identifying the group (ex.: Gr1).

<Group Name>: Name of the group (ex.: Sectorial 1)

<Skew Angle>: Skew angle of the current group (ex.: 90°) taking into account the skew angle of the probe and of the beam.

<Beam Angles>: Angle or range of beam angles (ex.: 40° to 60°)

Rulers

The rulers are scales displayed at the left and at the bottom of a view. The color of the ruler identifies the axis. The units and number of precision digits can be adjusted using the **View Properties > Units** tab.

Zoom bar

Zoom bars appear at the left and bottom edges of a view. Each zoom bar contains a zoom box, which enables you to set the visible part of the view. The zoom box shows the relative position and the proportion of data currently visible in the data display area relative to the contents of the entire inspection domain. The color of the zoom bar identifies the axis on the different views. You can resize the zoom bar by dragging its ends to zoom in or out and scroll the zoom bar to see other parts of the data. You can use the mouse wheel with or without the CTRL key to scroll the zoom bars.

Grid

The grid consists of thin horizontal and vertical lines that are displayed in the curve area to facilitate measurements and correspondence with the rulers. Depending on the distance between lines, the grid might be coarse, medium, or fine. The grid can be activated and customized using the **View Properties > Display** tab.

Cursors

The cursors are thin horizontal and vertical lines that are used to measure the data displayed in views and to identify a region in the view. A label indicates the exact

measure of each cursor. Two cursor types are available for a view: reference and measurement cursors.

You can quickly display the reference cursor by double-clicking in a view. Similarly, double-right-click in a view to display the measurement cursor.

3.7.1 Data View Types

Data views are graphical representations of the ultrasonic data. There are three types of ultrasonic views:

1. Basic views:
   - A-scan
   - S-scan
2. Volumetric views:
   - Side (B)
   - Top (C)
   - End (D)
   - Polar
3. Scrolling views:
   - Scrolling B-scan
   - Scrolling strip chart (position)
   - Scrolling strip chart (amplitude)

You can select the data view type for a view by selecting the view, and then clicking or pressing SHIFT+ENTER to open the **Contents** dialog box (see example in Figure 3-18 on page 75). In the **Contents** dialog box, the available data view types depend on various parameters including the acquisition type (conventional [] or phased array [ ]) and the mode (Setup, Inspection, or Analysis).

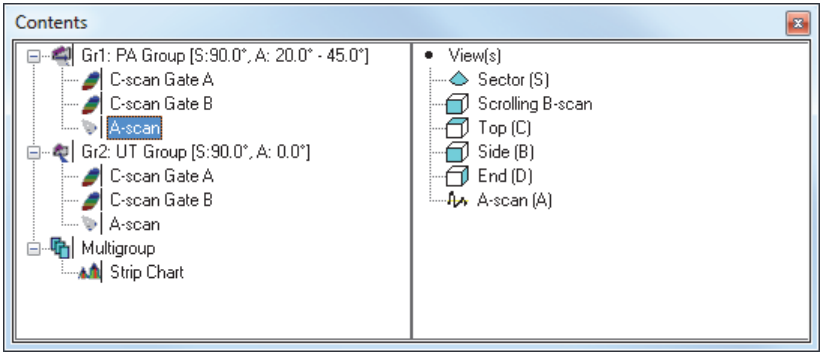

Figure 3-18 Example of data view types for phased array data

TIP

A view appears empty when its content (conventional [ ] or phased array [ ]) is not available in the current data file.

3.7.1.1 Basic Views

The following is a description of each type of basic view.

A-scan view

The A-scan view is the basis for all other views. It is a representation (view) of the received ultrasonic pulse amplitude versus time of flight (ultrasonic path), or a waveform. The A-scan view is displayed in real time (see example in Figure 3-19 on page 76). A peak in the signal is associated with the echo of a defect or a discontinuity in the specimen. Peaks at the start and the end of the ultrasonic axis are generally associated with the echo of the specimen's entry surface (front wall) and the back wall.

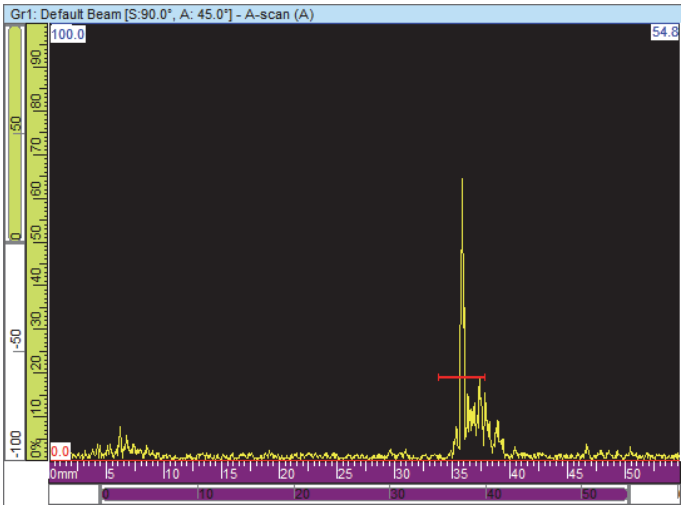

Figure 3-19 Example of an A-scan view

Sectorial views

NOTE

Sectorial views are only available for phased array channels.

Sectorial views are representations of the juxtaposition of the A-scans associated with each focal law of a phased array scan. They present a 2-D view of the sector covered by the scan. Figure 3-20 on page 77 shows the three types of sectorial representation for a given data set.

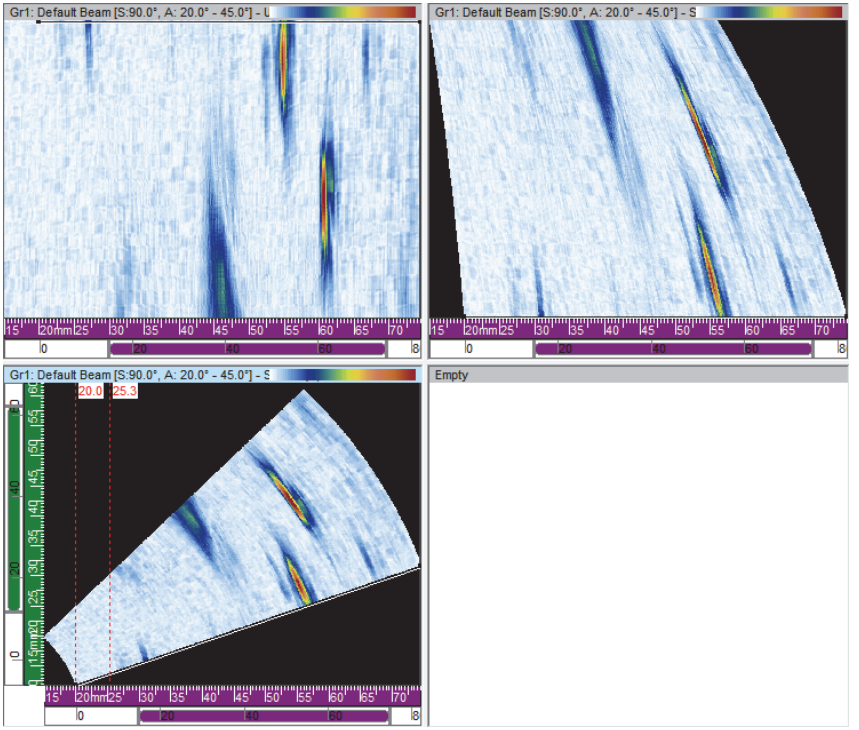

Figure 3-20 Example of Uncorrected (top-left), USound corrected (top-right), and VC sectorial (bottom-left) scans

The three sectorial scan view types are:

Uncorrected sectorial scan

View where the A-scan of each focal law (see top-left view of the example in Figure 3-20 on page 77) is represented by a horizontal line on which the amplitude is color-coded. The displayed real-time data shows the focal laws stacked (vertically in the example) in the order that they were generated.

Sectorial scan (Usound corrected)

View similar to the uncorrected sectorial scan except that the A-scans are corrected for delay and true depth so that their positions are accurate relative to the ultrasonic axis (see top-right view of the example in Figure 3-20 on page 77).

VC sectorial scan

Volume-corrected view similar to the uncorrected sectorial scan except that the A-scans are corrected for delay and refracted angle so that the positions are accurate relative to the ultrasonic and scan axes. A typical S-scan sweeps through a range of angles using the same focal distance and elements. The horizontal axis corresponds to the projected distance (test-piece width) from the exit point for a corrected image and the vertical axis corresponds to the depth (see bottom-left view of the example in Figure 3-20 on page 77).

When an azimuthal scan is defined by the calculator, the sectorial-scan view represents an angular sector where each line of this view corresponds to the A-scan of a different angle. Therefore, when a linear scan is defined, the sectorial-scan view represents the beam movement. Each line then corresponds to an A-scan of different aperture. Finally, when a depth scan is defined, the sectorial-scan view then represents the beam focusing at different depths. Each line then corresponds to a different A-scan.

3.7.1.2 Volumetric Views

Volumetric views are color-coded images built from successive A-scans projected on different planes defined by the ultrasonic, scan, and index axes. The most important views, similar to 2-D projections of a technical drawing, are presented in Figure 3-21 on page 79.

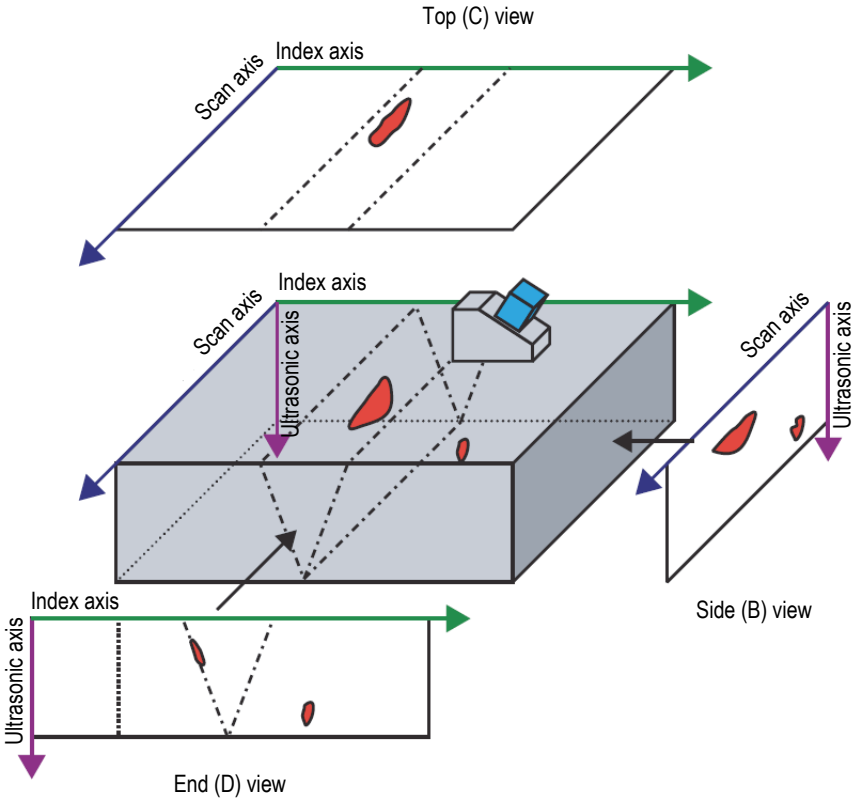

Figure 3-21 Example of ultrasonic views [Top (C), Side (B), and End (D)] with probe skew angle of 90°

In Figure 3-21 on page 79, if the probe skew angle is 0° (or 180°), the Side (B) view becomes the End (D) view, and vice versa. The Side (B) view is defined by the depth and probe-movement axes. The End (D) view is defined by the depth and the electronic-scan axis.

Side (B)

The Side (B) view (Figure 3-22 on page 80) is a two-dimensional graphical representation of the recorded data. One of the axes is the scan axis; the other is the uncorrected ultrasonic (USound) path. The position of the displayed data is related to

the encoder positions at the moment of acquisition. At a given position on the projected image, the color corresponds to the maximum amplitude at this position as detected in the considered index-axis range.

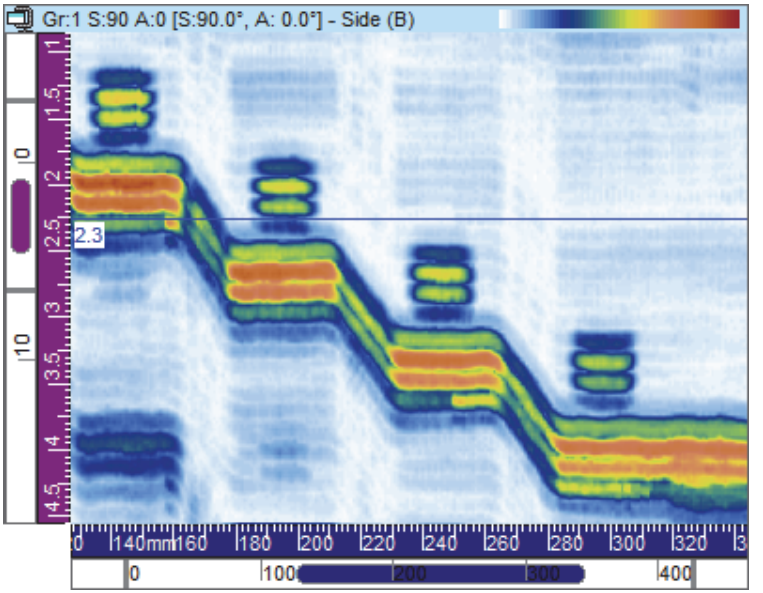

Figure 3-22 Example of Side (B) view

Top (C)

The Top (C) view (Figure 3-23 on page 81) is a two-dimensional graphical representation of the recorded data displayed as a top view of the test specimen. One of the axes is the scan axis; the other is the index axis. The position of the displayed data is related to the encoder positions at the moment of acquisition. At a given position on the projected image, the color corresponds to the maximum amplitude at this position as detected in the considered true-depth range.

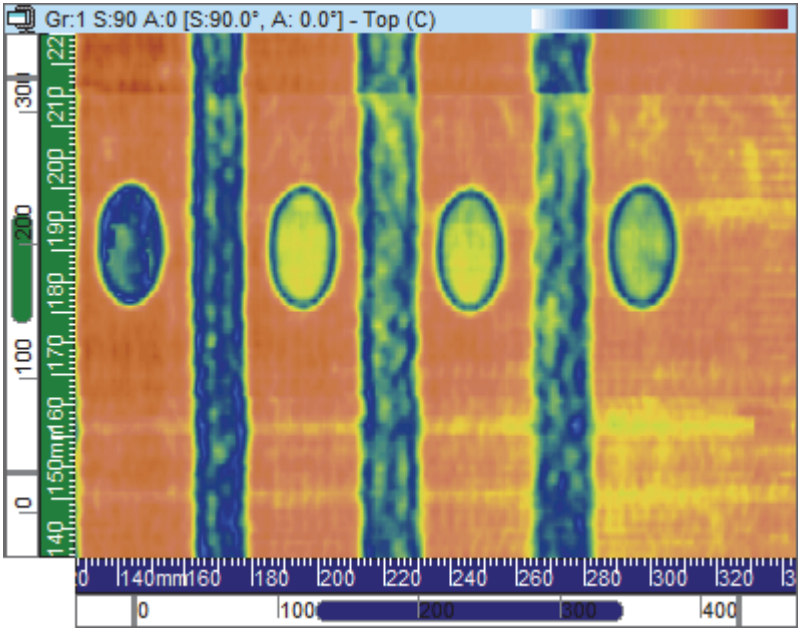

Figure 3-23 Example of Top (C) view

End (D)

The End (D) view (Figure 3-24 on page 82) is a two-dimensional graphical presentation of the recorded data. One of the axes is the defined index axis; the other is the uncorrected ultrasonic (USound) path. The position of the displayed data is related to the encoder positions at the moment of acquisition. At a given position on the projected image, the color corresponds to the maximum amplitude at this position as detected in the considered scan-axis range.

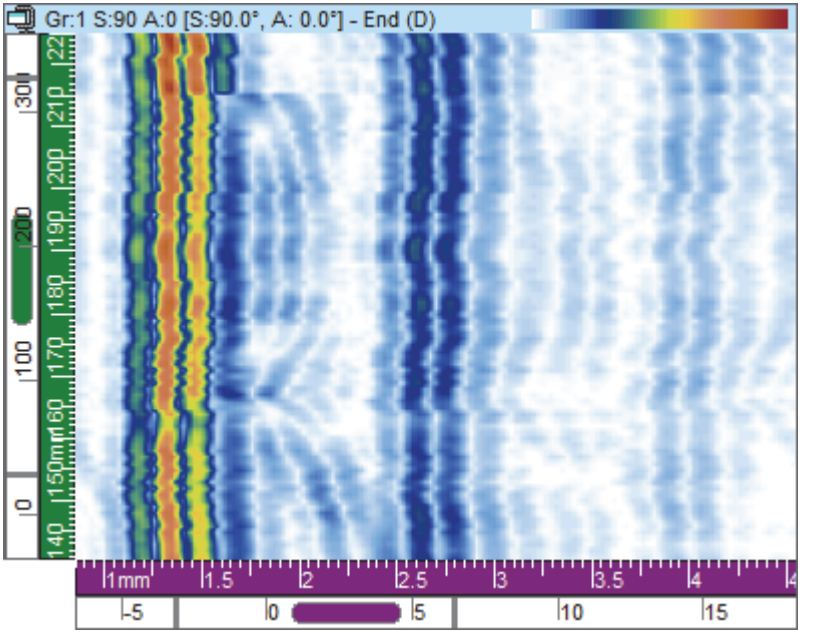

Figure 3-24 Example of End (D) view

Polar view

NOTE

The Polar view is available only when the geometry of the specimen is identified as cylindrical. This can be done by clicking (part and material definition) and then, in the **Part Definition** dialog box, defining the part as **Cylindrical**.

The Polar view (Figure 3-25 on page 83) is a two-dimensional representation of the recorded data in a realistic cylindrical geometry. It is used in Analysis mode. The readings in the **Cylindrical Correction** category are calculated taking into account the previously defined specimen.

Depending on the orientation of the scan axis relative to the cylindrical geometry, and the skew angle of the considered probe, the Polar view is the cylindrical equivalent of either the VC-Side (B) view or the VC-End (D) view. Either distance units (mm or in.) or rotational units (°) can be used and displayed in the circumferential direction of the cylinder.

NOTE

The Polar view is only supported for skew angles of 0°, 90°, 180°, and 270°; however, for data with other skew angle values, the **Cylindrical Correction** view information can be used to calculate the correct position and size of indications.

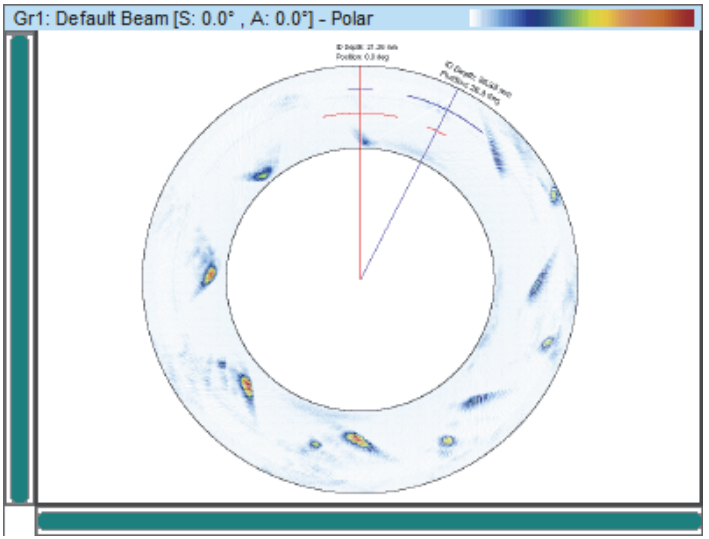

Figure 3-25 Example of a Polar view

3.7.1.3 Scrolling Views

Several types of scrolling views are available on FocusPC, as described below.

Scrolling B-scan

In the Scrolling B-scan view (Figure 3-26 on page 84), each A-scan is represented by a horizontal line on which the amplitude is color-coded. The lines are added consecutively in real time, from the bottom, so that the resulting image scrolls up. Therefore, the data view shows the real time vertically, versus the time of flight of the received ultrasonic pulse horizontally.

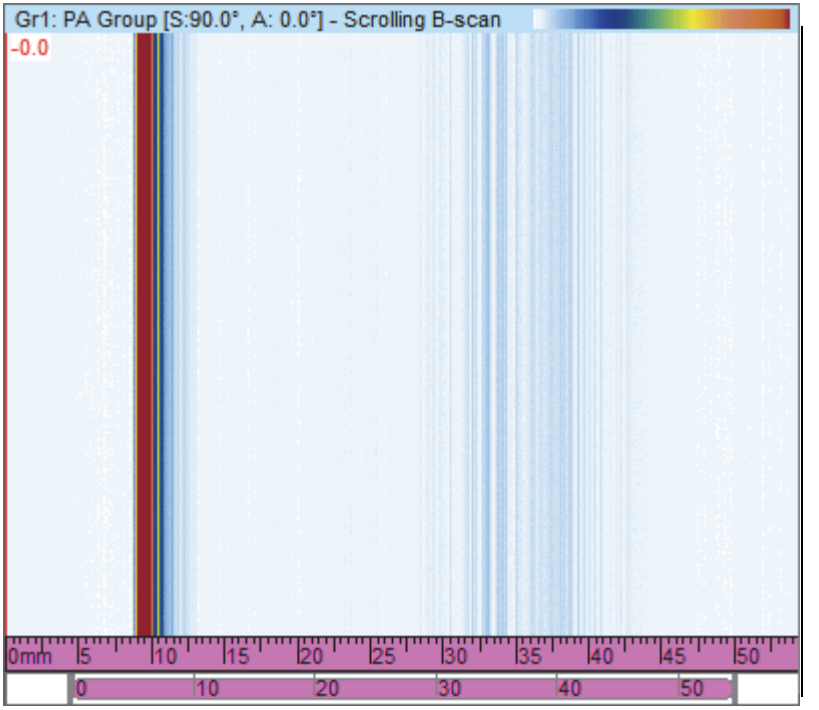

Figure 3-26 Example of Scrolling B-scan view

Strip charts — amplitude and position scrolling views

NOTE

The amplitude and/or position scrolling views are only available when the options for the recording of the selected amplitude and/or position data are enabled on the **Gates** tab of the **UT Settings** dialog box (refer to the *FocusPC Advanced User's Manual*).

In an amplitude or position scrolling view, the data of the signal crossing the associated gate is represented by a color-coded Scrolling view, which is displayed inside a Strip Chart view. The Scrolling view can be configured using the **Configuration** tab of the **View Properties** dialog box (available only when a Strip Chart view is selected).

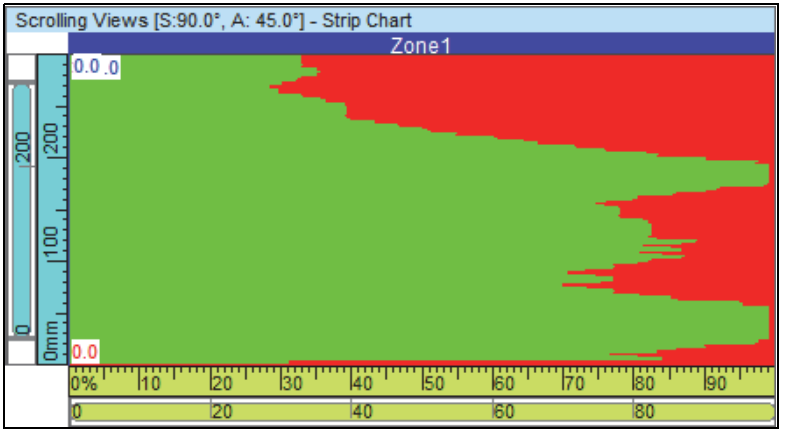

Figure 3-27 Example of amplitude scrolling view

3.7.2 View Shortcut Menu

When a data view type is assigned to a view, display options are available from a shortcut menu. The shortcut menu appears when you right-click the title bar of a view (see example shown in Figure 3-28 on page 86).

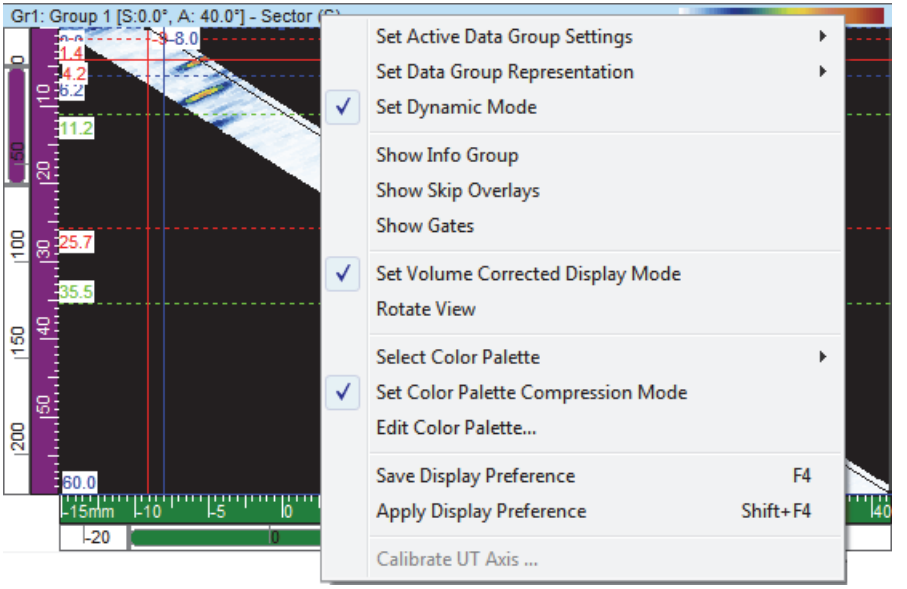

Figure 3-28 Example of the shortcut menu for a view

The view shortcut menu changes depending on the view type. The possible view shortcut menu commands are the following:

Data commands

Set Active Data Group Settings

Provides one or more choices (**Active Group**, **Active Law**, and **Active Gate**) to set the view to show data for the active item (group, beam, or gate), automatically following changes of the active selection.

Set Single Slice (Projection)

Toggles between the single- and projection-data displays in the view. The command is also available in the **Data Source** tab of the **View Properties** dialog box.

Set Data Group Representation

Provides one or more choices for sectorial scans (**Sector (S)** and **TOF**) [when you right-click on a view], and for C-scans (**Stacked**, **Single Beam**, **Strip**, and **Scrolling Strip**).

Restore Initial Gates

Only available in Analysis mode, this selection is used to reposition all gates either for the current group or for all groups to the positions where they were when the data was originally acquired.

Set Dynamic Mode

Only available in Setup and Inspection mode, this selection is used to toggle between the dynamic state and the analysis state (off-line).

Show commands

Show Info Group

Toggles the appearance of the information groups below the title bar of the view.

Show Gate Selectors

Toggles the appearance of the gate selectors on the selected view.

Show Zoombar and Rulers

Toggles the appearance of the zoom bars and the rulers. The command is also available in the **Display** tab of the **View Properties** dialog box.

Show Echo Dynamics

Toggles the appearance of the echo dynamics signals next to the relevant axis. The echo dynamic curves show the maximum amplitude (or minimum position) between the measurement and reference cursors (see example shown in Figure 3-29 on page 88). The command is also available in the **Echo Dynamics** tab of the **View Properties** dialog box.

Show Skip Overlays

Toggles the appearance of the overlay lines representing the skips. The command is also available in the **Overlay** tab of the **View Properties** dialog box.

Show Rebounds

Toggles the appearance of the rebounds (see example shown in Figure 3-29 on page 88).

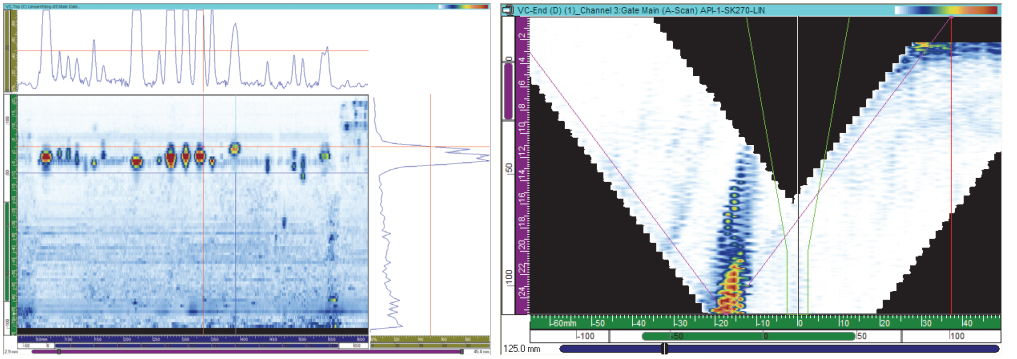

Figure 3-29 Examples of shown echo dynamic curves and rebound

Show Gates

Toggles the appearance of the gates. This option is only available for A-scan and S-scan views. The command is also available in the **Overlay** tab of the **View Properties** dialog box.

Display mode commands

Set 1:1 Ratio Display Mode

Displays the view with the same scale on both axes. The command is also available in the **Display** tab of the **View Properties** dialog box.

Set Smoothing Display Mode

Enables the smoothing function. The command is also available in the **Display** tab of the **View Properties** dialog box.

Set Volume Corrected Display Mode

Toggles the A-scan correction for delay and refracted angle so that the positions are accurate, relative to the ultrasonic and scan axes.

Rotate View

Rotates the data so that the two axes interchange. The command is also available in the **Display** tab of the **View Properties** dialog box.

Color palette commands

The following shortcut menu commands are also available on the **Palette** tab of the **View Properties** dialog box. These commands are only available on the menu when the view supports a color palette.

Select Color Palette

Used to select one of the available color palettes (**Rainbow**, **Gray**, **Thickness**, or **Balanced**).

Set Color Palette Compression Mode

Toggles the state of the color palette compression. When you reduce the range for the 256 colors of a palette without compression, you remove colors from the palette. With compression, all palette colors are compressed in the new range.

Edit Color Palette

Opens the **Palette Editor** dialog box, where you can edit existing color palettes or create new color palettes.

Display preferences commands

Save Display Preference

Saves the current view properties as the default properties.

Apply Display Preference

Applies the default view properties to the currently selected view.

TIP

On the keyboard, press F4 and SHIFT+F4 to respectively activate the **Save Display Preference** and the **Apply Display Preference** commands.

Ultrasonic axis commands

Reverse USound Axis

Reverses the direction of the ultrasonic axis. The command is only available for the A-scan view. The command is also available on the **Display** tab of the **View Properties** dialog box.

Change USound True Depth / Half Path

Toggles the ultrasonic axis unit between true depth and half path. The command is only available for the A-scan view when the ultrasonic axis is set to either true depth or half path.

Change USound TOFD / Time

Toggles the ultrasonic axis ruler between TOFD and time. The command is only available for the A-scan view when the ultrasonic axis is set to either time or TOFD.

TIP

You can set the type and the units of USound axis in the **Units** tab of the **View Properties** dialog box.

Calibrate UT Axis

Only available in Analysis mode, this command opens the dialog box for the calibration of the **True Depth**, the **Half Path**, or the **TOFD** on the ultrasonic axis. The command is also available on the **Units** tab of the **View Properties** dialog box and in Setup mode, on the **General** tab of the **UT Settings** dialog box.

3.8 Readings and Information Groups

FocusPC computes reading values for various parameters to help you analyze your ultrasonic data. Readings are calculated using cursor, zone, or acquisition parameters.

You can select to display one or more groups of readings at the top of a view (Figure 3-30 on page 91).

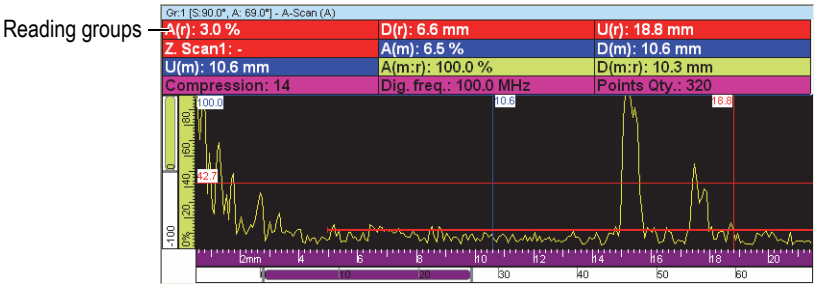

Figure 3-30 Example of reading groups appearing at the top of a view

See “Working with the Readings” on page 135 for more information on how to customize the reading groups.

3.9 Gates

A gate is a signal processing tool that isolates a time domain region of the received ultrasonic signal in order to process it further. In an A-scan view, a gate appears as a horizontal line with short vertical lines at both ends. The vertical position of the gate line indicates the signal detection threshold (Figure 3-31 on page 92). When the rectification of the receiver is set to RF, the threshold of a gate can be positive or negative.

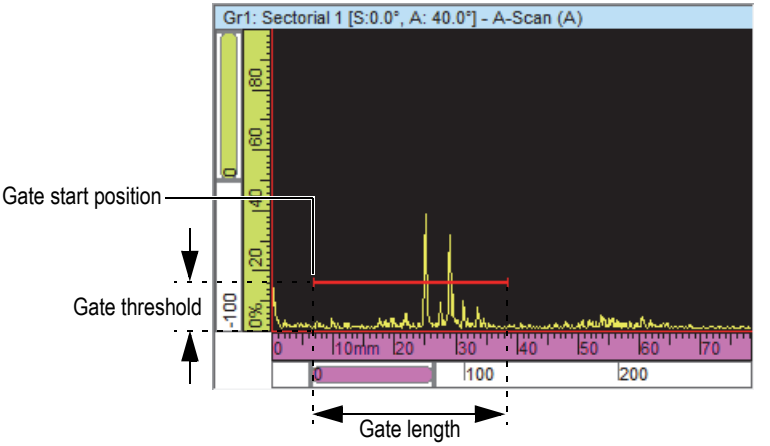

Figure 3-31 Example of gate A in an A-scan

In an S-scan view, the gate start and end positions appear as horizontal dashed lines (Figure 3-32 on page 92). When the time base mode is set to true depth, the area in between is the gated zone for all beams. When the time base mode is set to half path, the area between the dashed lines is the gated zone for the current beam only. The dashed lines of the gate automatically move to the appropriate location when you change the current beam.

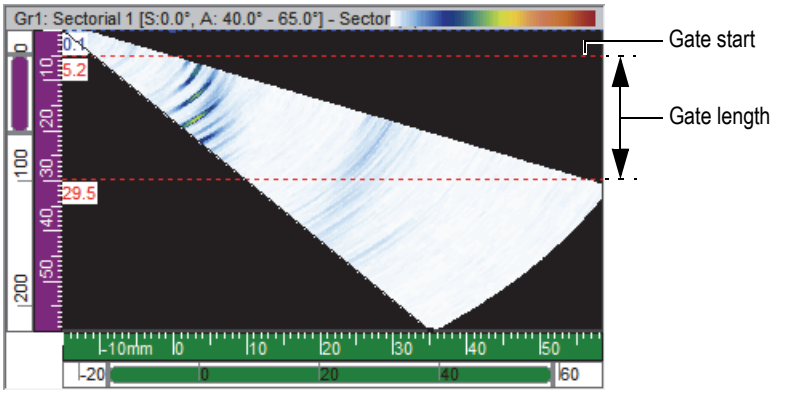

Figure 3-32 Example of gate A in an S-scan

FocusPC supports up to five gates (gate I, gate A, gate B, gate C, and gate D), allowing you to perform complex signal processing. The function of gate I, the interface gate, is to identify the interface of the inspected part. Gate A, B, C, and D are general purpose gates (see “Gate Usage Example” on page 143). Each gate has its own color to easy identification (Figure 3-33 on page 93).

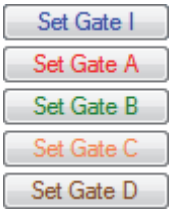

Figure 3-33 Gate colors

3.10 Expert Mode

FocusPC includes an Expert mode in which a larger number of readings are available. The categories of readings available in the **Information Groups** dialog box when Expert mode is active are shown in Figure 3-34 on page 93.

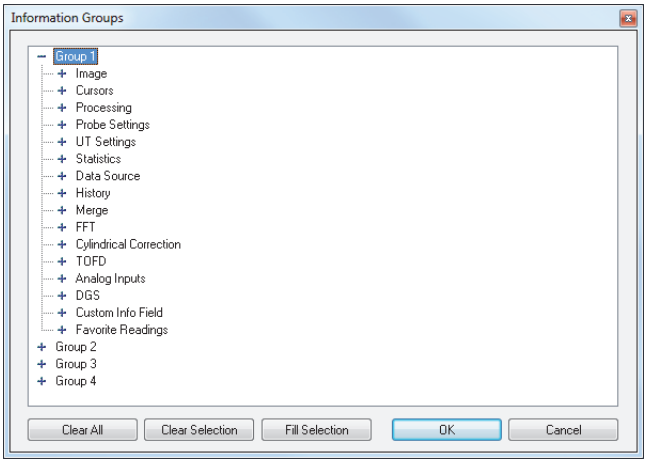

Figure 3-34 Categories of readings in the Expert mode

To activate/deactivate Expert mode

1. On the main menu bar, select **File > Preferences**.
2. In the **Preferences** dialog box, select the **General Settings** tab.
3. Under **Interface**, select or clear the **Expert mode** check box, to respectively activate or deactivate the Expert mode.

3.11 File Formats

FocusPC can produce, open, and import various data types stored in various file formats listed in Table 3 on page 94.

Table 3 File formats supported by FocusPC

File type	Extension	File content
Hardware setup	.fps	Setup of the acquisition instrument
Data	.fpd	Data file that contains display setup information and acquisition setup information
Display setup	.rst	Display setup: layouts and system preferences
Report	.r01	Report information including indication zone data
Calculator setup	.xcal	Calculator extended setup file
	.cal	Calculator setup file
	.law	Calculated beam parameters
	.pac	Calculated beam parameters readable by FocusPC
Attributes	.A01	Attributes: data modified in analysis and associated with the .fpd file

The hierarchical content of the file formats generated by FocusPC is illustrated in Figure 3-35 on page 95.

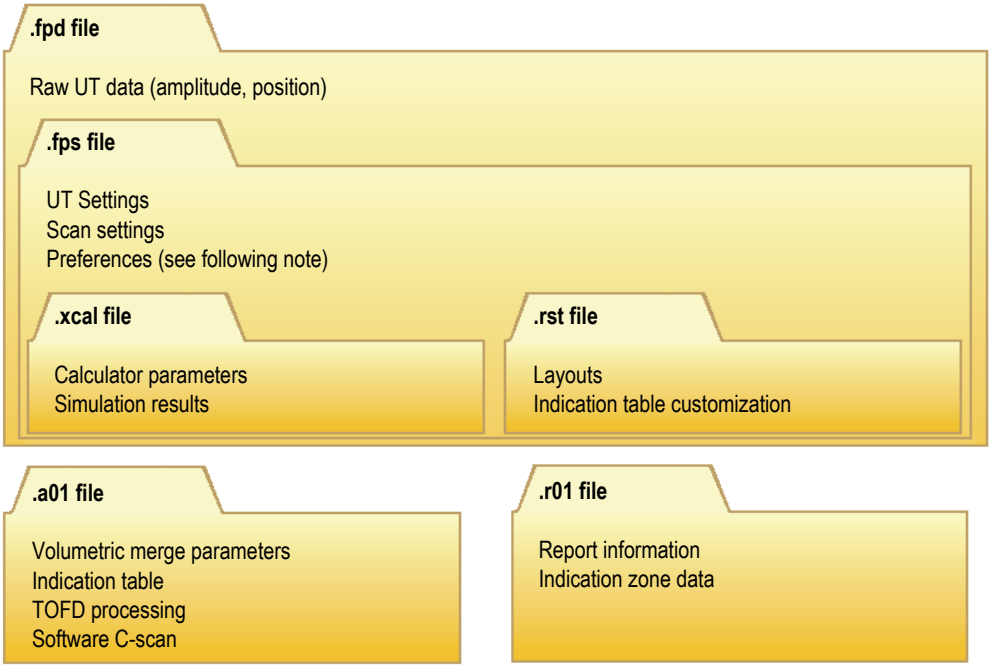

Figure 3-35 FocusPC file organization

NOTE

The preferences data saved in the .rst file include view linking options, axis colors, view colors, tool colors, and the measurement system. By default, the contents of the .rst file is included in the .fps file.

NOTE

You can customize the default folders for the various data file types (refer to the *FocusPC Advanced User's Manual* for details).

4. Setup Creation

A FocusPC configuration can be saved in the .fps (acquisition, also referred to as the setup) file, which can be recalled at any time. This section describes the basic steps for creating a setup file using FocusPC, starting from the default configuration.

4.1 Working with Setup Files

The following section describes how to create setup files.

4.1.1 Loading an .fps Setup File

The FocusPC configuration can be stored in the .fps file. An .fpd (data) file can also be recalled to load the .fps configuration that was used at the time when the data was recorded. You can reload the parameters into the ultrasonic acquisition instrument to perform acquisition with the same parameters or to display the parameters that were used for acquisition.

To load an .fps setup file

1. On the main menu bar, click **File > Open** to open a setup file.

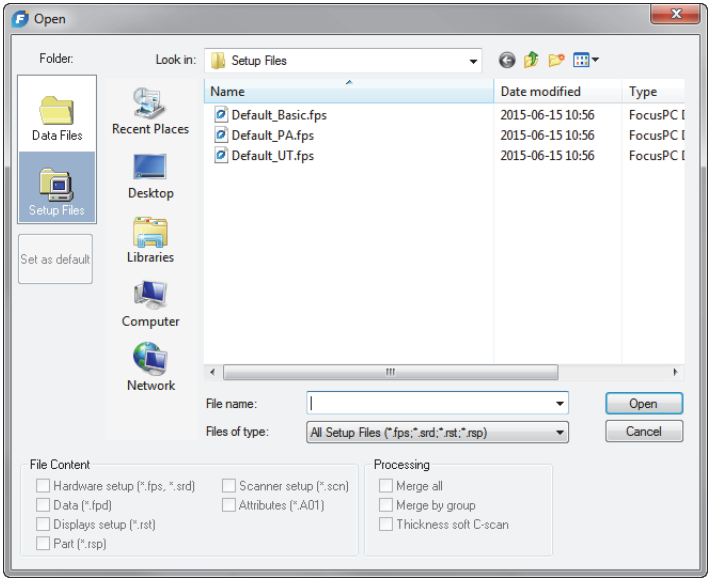

Figure 4-1 Open dialog box

2. In the **Open** dialog box that appears (Figure 4-1 on page 98), proceed as follows:
   a) If a data file was selected, clear the **Data (*.fpd)** check box.
   b) In the **File Content** section, select the file to be loaded.
   c) Click **Open**.

4.1.2 Saving an .fps Setup File

To save an .fps setup file

1. On the main menu bar, click **File > Save As** to save a setup file.
2. In the **Save As** dialog box that appears (Figure 4-2 on page 99), proceed as follows:
   a) For the **.fps** file to be saved, enter the **File Name**.
   b) In the **File Content** section, select the elements to be saved.
   c) Click **Save** to save the .fps file.
   OR

Click **Set as default** to make this setup file the new default configuration.

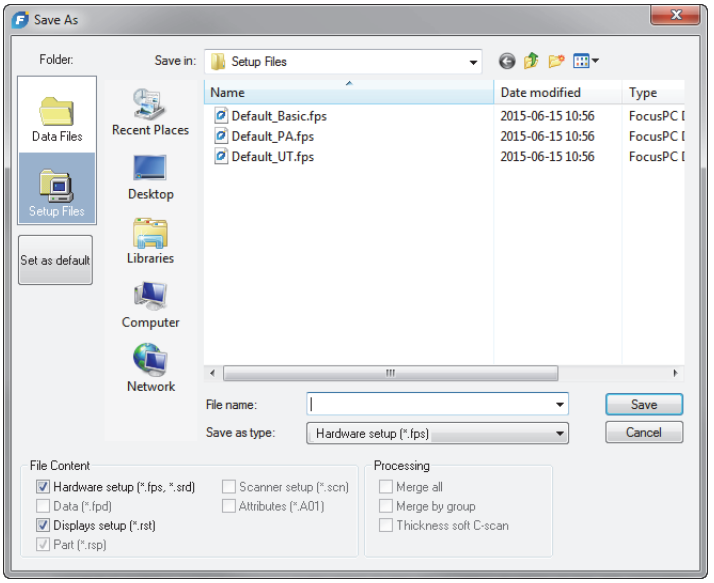

Figure 4-2 Save As dialog box

4.1.3 Default Setup Files

FocusPC comes with a number of default setup files that are designed to provide a good starting point.

The default setup files are available in the default setup file folder ([Installation Folder]\EvidentNDT\FocusPC*nnn*\Setup Files).

4.2 Working with Groups

In FocusPC, a *group* is a defined configuration of parameters to generate one or more ultrasonic beams using a conventional or phased array probe. A group can pulse and receive on the same probe, or you can use two different probes, one to pulse, and the other to receive, and a probe can be used by more than one group. The following sections describe how to create and configure phased array and conventional UT groups (see “Groups” on page 61 for more information on groups).

4.2.1 Adding and Configuring a Phased Array Group

The following procedure describes how to create a phased array group in FocusPC. Although some of the steps may not be mandatory for all inspection types, it provides an overview of the power and flexibility of FocusPC.

To add and configure a phased array pulse-echo group

1. On the Dashboard, click to add a group (Figure 4-3 on page 100).

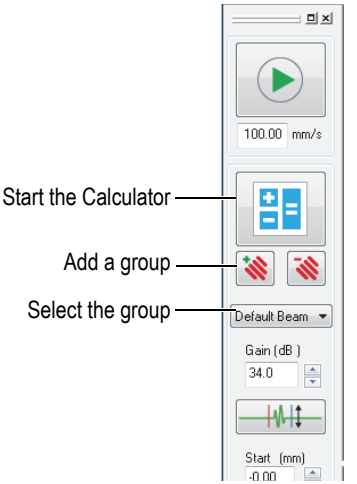

Figure 4-3 Adding or selecting a group

2. In the **Group Creation Wizard** dialog box that appears (Figure 4-4 on page 101), proceed as follows:
   a) Select **Phased array** for the type of group to create.
   b) Enter a name for the new group in the **Specify name** box (for example: Angle Beam).
   c) Click **Finish**.

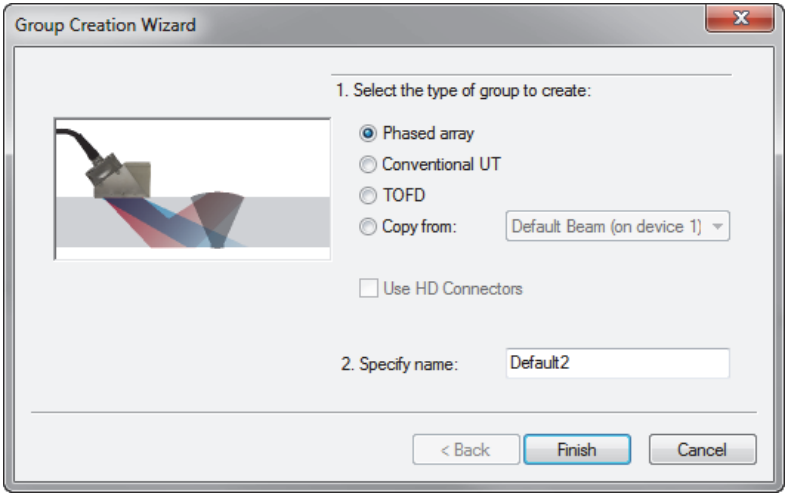

Figure 4-4 Group Creation Wizard dialog box

3. On the Dashboard (Figure 4-3 on page 100), proceed as follows:
   a) Select the newly created group.
   b) Click to open the Calculator.
   The Calculator is where you specify the probe and wedge used for the inspection, the geometry and material of the inspected part, and the beam configuration. See "Calculator" on page 63 for details.
4. In the Calculator, perform the following tasks:
   a) For an angle beam phased array inspection, click the **1-D Linear Array** tab (Figure 4-5 on page 102).

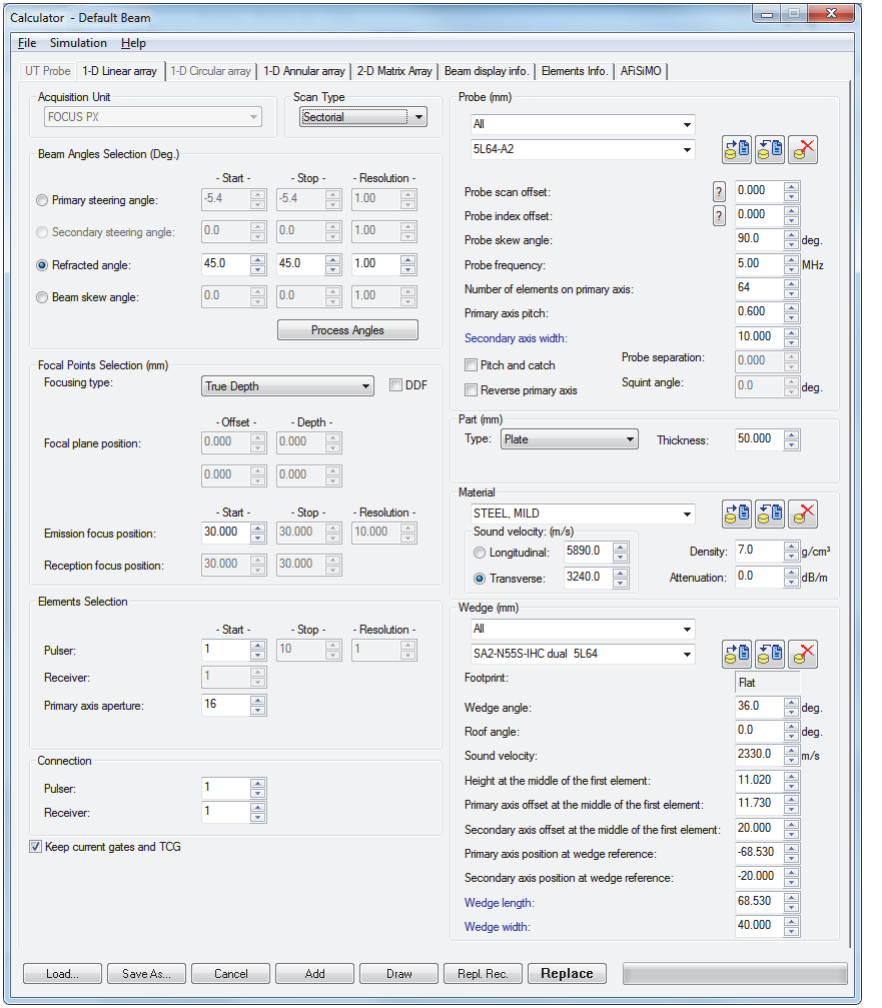

Figure 4-5 Calculator dialog box

b) Under **Probe**, select the type of probe (**Angle Beam**) and the probe model (Figure 4-6 on page 103).

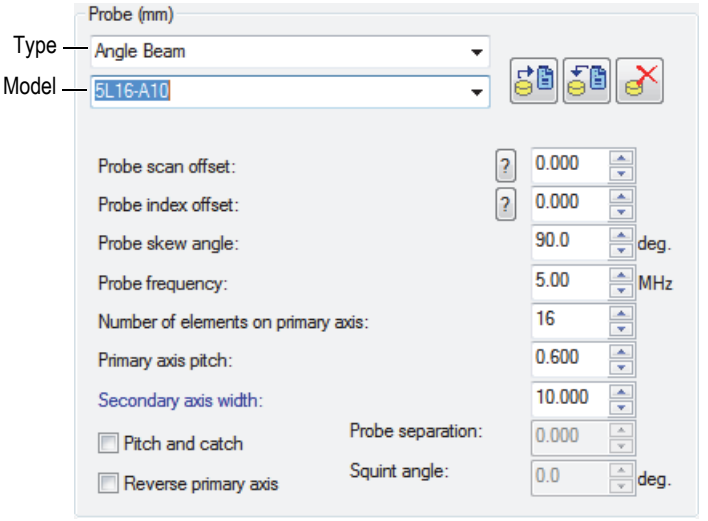

Figure 4-6 Selecting the probe

c) Under **Part**, select the inspected part geometry type and enter its thickness (Figure 4-7 on page 103).

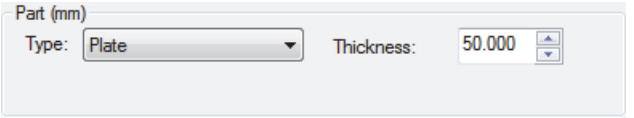

Figure 4-7 Specifying the inspected part geometry

d) Under **Material**, select the inspected part material and the **Longitudinal** or **Transverse** ultrasonic wave type (Figure 4-8 on page 104).

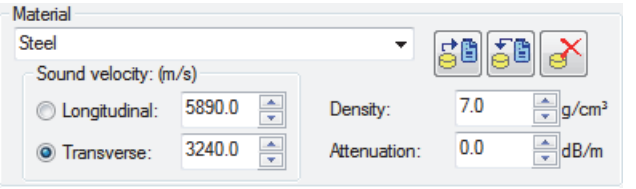

Figure 4-8 Specifying the inspected part material

e) Under **Wedge**, select the type of wedge and the wedge model (Figure 4-9 on page 104).

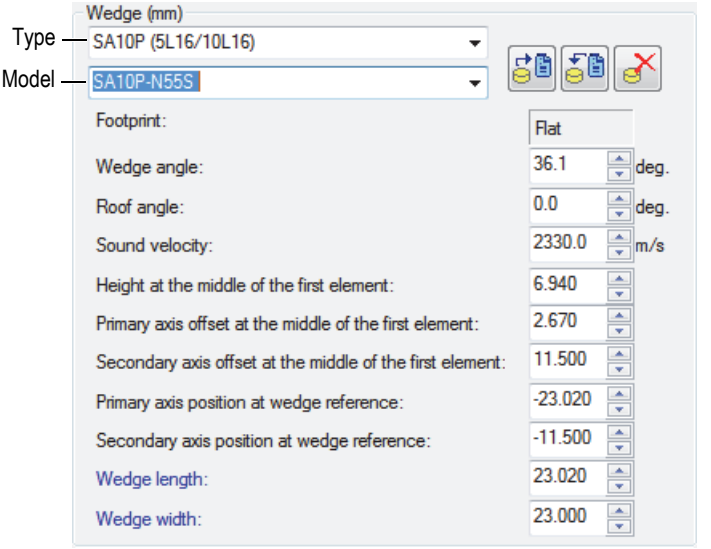

Figure 4-9 Specifying the wedge

f) In the **Scan Type** list, for an angle beam inspection, select **Sectorial**, **Depth**, **Static**, or **Linear**. For more information on the differences between the Scan Types, refer to the *Advanced NDT Series* books available for free on the Evident website.

g) Under **Beam Angles Selection**, select **Refracted angle**, and then specify the **Start** value and the **Stop** and **Resolution** values if they are available (depends on the selected **Scan Type**).

h) Under **Focal Points Selection**, set the **Focusing type** to **True Depth**, **Half Path**, **Projection**, or **Focal Plane**, and if desired, select if you want to have dynamic depth focusing (DDF) activated. Then, define the **Focal plane position**, **Emission focus position**, and **Reception focus position** if available.

i) Under **Elements Selection**, select **Primary axis aperture**, and then enter the number of elements to use for each focal law. Then, define the **Start**, **Stop**, and **Resolution** values if available.

j) Under **Connection**, set the **Pulser** and the **Receiver** values. This will define the element to use as the first element for the transmitter and receiver focal laws.

k) At the bottom of the Calculator, click **Draw**.

FocusPC prepares the beam display information.

l) Wait for the progress bar to complete.

m) At the top of the Calculator, click the **Beam display info** tab.

n) Use the four views and the parameters below the views to validate the calculated beams (Figure 4-10 on page 106).

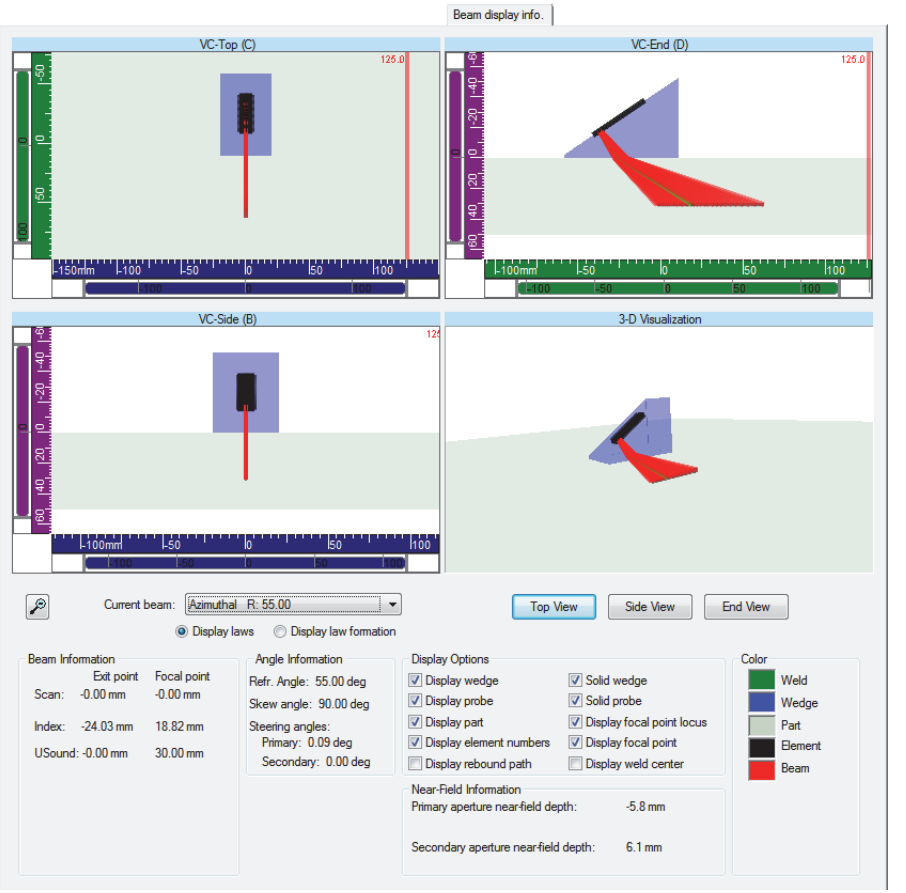

Figure 4-10 Example of the Beam display info tab in the Calculator

o) Return to the **1-D Linear array** tab, and then, if necessary, make further adjustment to the parameters.

p) At the bottom of the Calculator, click **Replace** to calculate the configured focal laws and send the information back to FocusPC.

To add and configure a phased array pitch-catch or through-transmission group

1. Follow steps 1 to 4.*e* of the procedure called "To add and configure a phased array pulse-echo group" on page 100.

2. Click to open the Calculator:
   a) Under **Scan Type**, select **Static**.
   b) Under **Beam Angles Selection**, select **Refracted angle**, and then specify the **Start** value for the Pulser.
   c) Under **Elements Selection**, define the **Start** and **Primary axis aperture** values.
   d) At the bottom of the Calculator, click **Replace** to calculate the configured focal laws and send the information back to FocusPC.

3. Click to open the Calculator:
   a) Under **Beam Angles Selection**, select **Refracted angle**, and then specify the **Start** value for the Receiver.
   b) Under **Elements Selection**, define the **Start** and **Primary axis aperture** values.
   c) Under **Probe**, define the **Probe skew angle** for the receiver, if necessary.
   d) At the bottom of the Calculator, click **Replace Rec** to calculate the configured reception focal laws and send the information back to FocusPC.

4. Click to open the Calculator:
   a) In the **Phased Array Parameters Source** dialog box (Figure 4-11 on page 107), select the sector to be edited, and then select **Emission** and click **OK**.

      The Calculator will open with the corresponding Pulser configuration.
   b) In the Calculator, click **Add**.

      This will add a new beam with a similar configuration to the one defined in step 2.

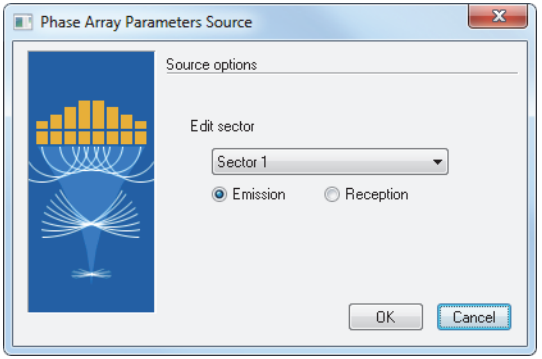

Figure 4-11 Phased Array Parameters Source dialog box

5. Click to open the Calculator:
   a) In the **Phased Array Parameters Source** dialog box (Figure 4-11 on page 107), select the sector to be edited and then select **Emission**, and then click **OK**.
   b) Edit the different available parameters, if necessary.
   c) At the bottom of the Calculator, click **Replace** to calculate the configured focal laws and send the information back to FocusPC.
6. Click to open the Calculator:
   a) In the **Phased Array Parameters Source** dialog box (Figure 4-11 on page 107), select the sector to be edited, and then select **Reception** and click **OK**.
   b) Edit the different available parameters, if necessary.
   c) At the bottom of the Calculator, click **Replace Rec** to calculate the configured reception focal laws and send the information back to FocusPC.
7. Repeat steps 4 to 6 until all your beams are properly configured.

4.2.2 Adding and Configuring a CAF Group

The following procedure describes how to create a CAF group in FocusPC software. Although, some of the steps may not be mandatory for all inspection types, they provide an overview of the power and flexibility of FocusPC.

A coherent adaptive focusing (CAF) group enables the phased array beams to adapt to targets with varying geometries in real time. For each acquisition, an algorithm identifies the shape of the target and recalculates the focal law delays to generate an ultrasonic wave front that is parallel to the part's surface.

Setting the parameters of a CAF group (see "Working with CAF Groups" on page 149), is in most respects the same as a phased array group, though with some exceptions; for example, you cannot set up a pitch-catch configuration with CAF. Procedures for CAF groups (such as calibration) are performed in the same way as for phased array groups.

To add and configure a CAF group

1. Follow the same process as for the phased array group (see "Adding and Configuring a Phased Array Group" on page 100).
2. In the **Group Creation Wizard** dialog box, select **Coherent Adaptive Focusing (CAF)** (Figure 4-12 on page 109) instead of **Phased array**.

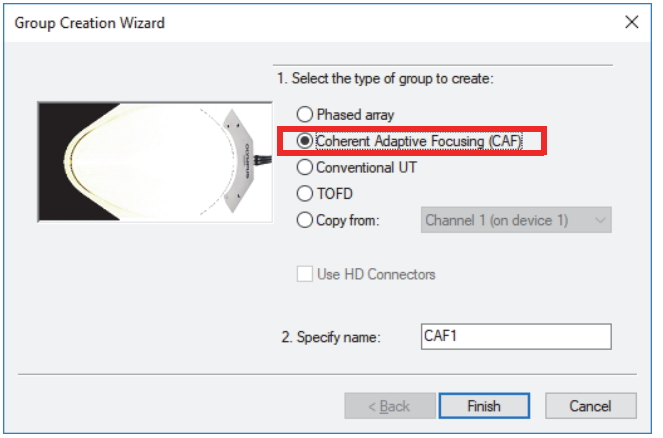

Figure 4-12 Group Creation Wizard dialog box

All subsequent creation steps are the same as a phased array group.

4.2.3 Adding and Configuring a Conventional UT Group

The following procedure describes how to create a conventional UT group in FocusPC. The configuration of a conventional UT group is not performed in the Calculator as is done for the phased array groups. Therefore, the acoustic configuration and part definition will need to be performed separately.

To add and configure a conventional UT group

1. On the Dashboard, click to add a group.
2. In the **Group Creation Wizard** dialog box that appears (Figure 4-13 on page 110), proceed as follows:
   a) Select **Conventional UT** for the type of group to create.
   b) Enter a name for the new group in the **Specify name** box (for example, Conventional Beam).
   c) If you want the **Conventional UT** group to be configured on the phased array connector rather than the HD connectors, clear the **Use HD Connectors** check box.
   d) Click **Finish**.

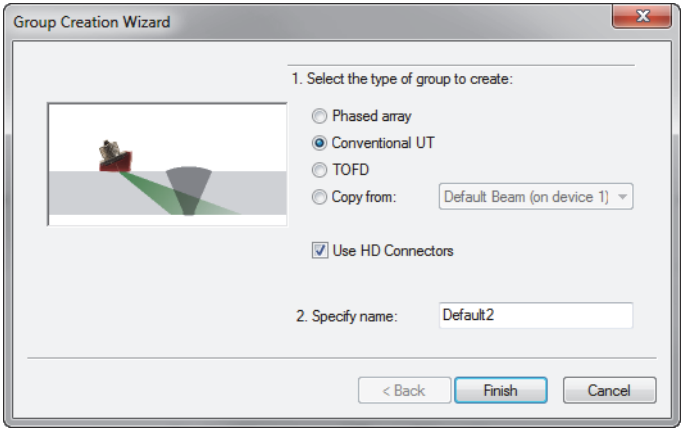

Figure 4-13 Group Creation Wizard dialog box (conventional UT)

3. On the component toolbar, click (part and material).
4. In the **Part Definition** dialog box (Figure 4-14 on page 111), proceed as follows:
   a) Under **Material Velocity**, set the ultrasonic velocities for the **Longitudinal waves** and **Transversal waves** in the part.
   b) Under **Dimensions**, set the values describing your part.
   c) For cylindrical parts, under **Probe Positioning**, select the appropriate **Inspection from** and **Scan orientation** values.
   d) Click **OK**.

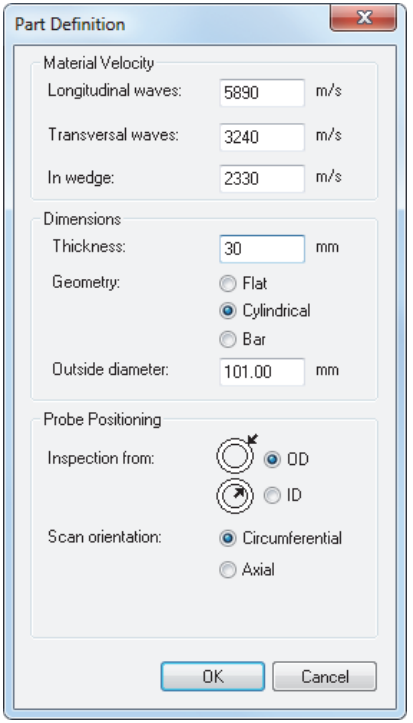

Figure 4-14 Part Definition dialog box

5. On the Dashboard, select the newly created group (Figure 4-15 on page 111).

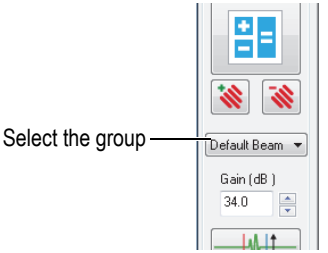

Figure 4-15 Selecting the UT group in the Dashboard

6. On the component toolbar, click the UT Settings button ( ).
7. In the **UT Settings** dialog box, proceed as follows:
   a) On the **Pulser/Receiver** tab, set the connectors for **Pulser** and **Receiver** along with the **Pulse width** value for your UT probe.

   Divide 500 by the probe frequency expressed in MHz to get the pulse width value expressed in ns (ex.: 500/10 MHz = 50 ns).

   b) On the **Position** tab, under **Probe**, define the **Scan offset** and **Index offset** values.

   c) On the **Position** tab, under **Beam**, enter the appropriate **Refracted angle** and **Skew angle** values.

4.2.4 Adding and Configuring a TOFD Group

The following procedure describes how to create a TOFD group in FocusPC. Just as for a Conventional UT group, the TOFD configuration is not performed in the Calculator. Therefore, the acoustic configuration is performed separately.

To add and configure a TOFD group

1. On the Dashboard, click to add a group.
2. In the **Group Creation Wizard** dialog box that appears (Figure 4-16 on page 113), proceed as follows:
   a) Select **TOFD** for the group type.

   b) Enter a name for the new group in the **Specify name** box (for example, TOFD group).

   c) If you want the **Conventional UT** group to be configured on the phased array connector rather than the HD connectors, clear the **Use HD Connectors** check box.

   d) Click **Finish**.

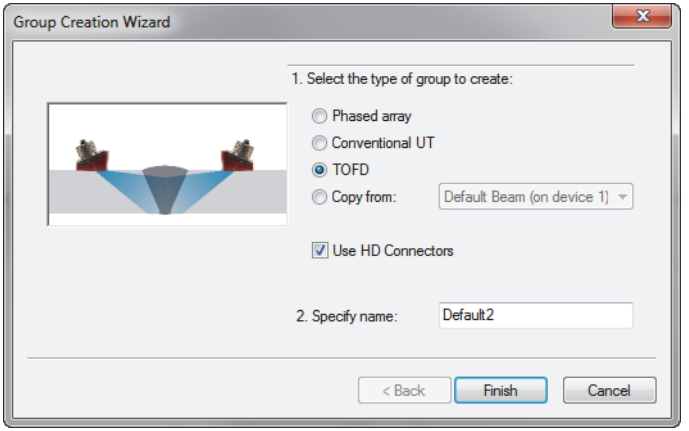

Figure 4-16 Group Creation Wizard dialog box (TOFD)

3. In the **UT Settings > Pulser/Receiver** dialog box:
   a) Under **Pulser**, set **Connector** to the value corresponding to the pulser connector number.
   b) Under **Receiver**, set **Connector** to the value corresponding to the receiver connector number.
   c) Set the **Voltage** to the highest value available.
   d) Set the **Pulse width** value for your UT probe.

   Divide the number 500 by the probe frequency (expressed in MHz) to obtain the pulse width value expressed in ns (ex., 500/10 MHz = 50 ns).

4.2.5 Switching between Groups

When you have more than one group in a configuration, you often need to switch the focus from one group to the other.

To switch between groups

1. Right-click the view header (at the top of the view) and select **Active Group** (Figure 4-17 on page 114).
2. On the Dashboard, change the active group.

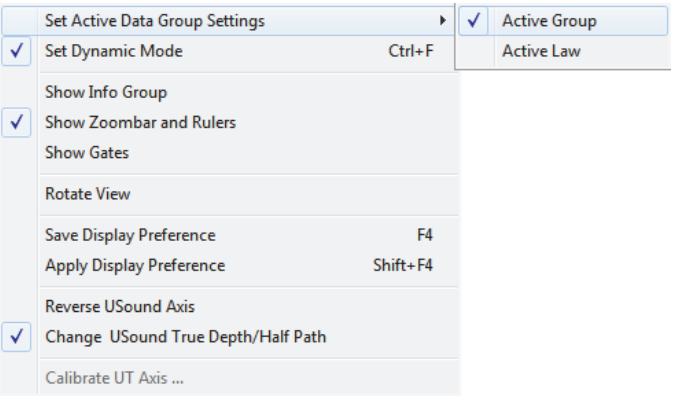

Figure 4-17 Selecting Active Group

4.2.6 Renaming Groups

To rename a group

1. Click to open the **UT Settings** dialog box.
2. In the **UT Settings** dialog box, select the **Group** you want to rename.
3. Click in the **Group** box, and then type the new group name.
4. Press **Enter**.

4.2.7 Deleting Groups

To delete a group

1. On the Dashboard, select the **Group** you want to delete.
2. Click the Delete button ( ).
   A message appears (Figure 4-18 on page 115), asking you to confirm deletion of the group.

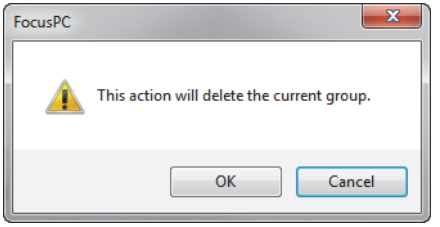

Figure 4-18 Message for deleting a group

3. Click **OK** to confirm the operation.

4.3 Calibrating a Phased Array Group

The phased array technique requires the calibration and verification of all the UT beams. The purpose of the calibration is to obtain a setup file that yields correct results regarding the position and amplitude of a known reflector in a calibration block.

The following sections present the calibration procedures to calibrate the beam delays and sensitivity for phased array groups. For the phased array TCG calibration procedure, see “Constructing a TCG Curve for a Phased Array Group” on page 129.

4.3.1 Calibrating the Beam Delays

The purpose of the phased array beam delay calibration is to adjust the delay of each beam so that the indication of a known reflector appears at the correct depth for all beams. This procedure must be performed for each group.

To calibrate the beam delays

1. On the component toolbar, click (Phased Array Calibration).
2. In FocusPC, in a Side (B), End (D), or Sector (S) view, position the Reference (red) and Measurement (blue) cursors respectively above and below the reference reflector of the calibration block (Figure 4-19 on page 116).

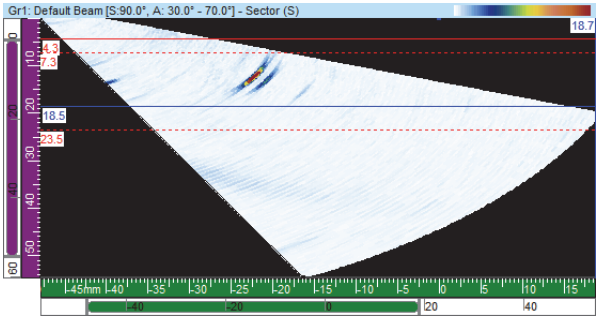

Figure 4-19 Example of cursors around an indication in a Sector (S) view

3. In the **Phased Array Calibration** dialog box, proceed as follows:

   a) Select the **Beam Delays** tab (Figure 4-20 on page 116).

   The graph presents the ultrasonic path between the **Reference** and **Measurement** cursors on the vertical axis and the beams on the horizontal axis.

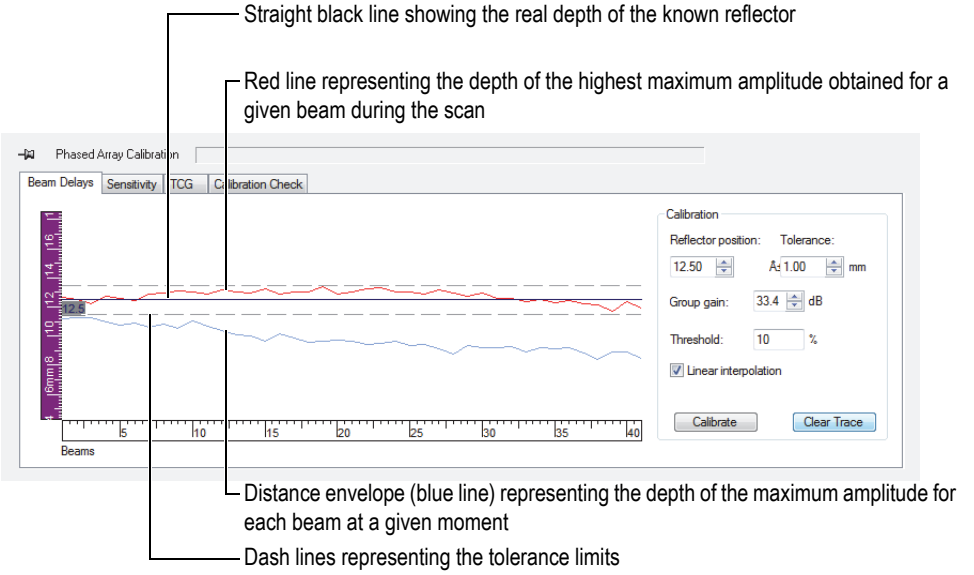

Figure 4-20 Curves for the beam delay calibration

b) Under **Calibration**, in the **Reflector position** parameter, enter the true depth of the known reflector used for this calibration.

c) If the reflector echo is too weak or too strong, adjust the **Group gain** parameter.

d) In the **Tolerance** parameter, enter the acceptable calibration tolerance.

e) Select the **Linear interpolation** check box to activate the averaging of the beam delays. The resulting line applies a global correction.

4. During the scan, the distance envelope (blue line) obtained for each beam is drawn, and a curve representing the position of the maximum amplitude is constructed (red line).
5. Place the probe on the calibration block and perform a first scan above the reference reflector.

IMPORTANT

After a scan, the maximum amplitude curve (red line) should already be close to the tolerance limits. When the maximum amplitude curve shape is significantly different, revise the configuration of all parameters in the Calculator.

---

6. In the **Phased Array Calibration** dialog box, click **Clear Trace** to clear the data from the previous scan.
7. Perform a new scan above the reference reflector on the calibration block.

   In the graph, the red line might not always appear within the tolerance lines.
8. Click **Calibrate**.

   The graph content is cleared and FocusPC calculates the wedge delay for each beam so that the reflector indication appears at the requested depth.
9. Perform a new scan above the reference reflector on the calibration block to validate the calibration by confirming that the red line appears within the tolerance lines.

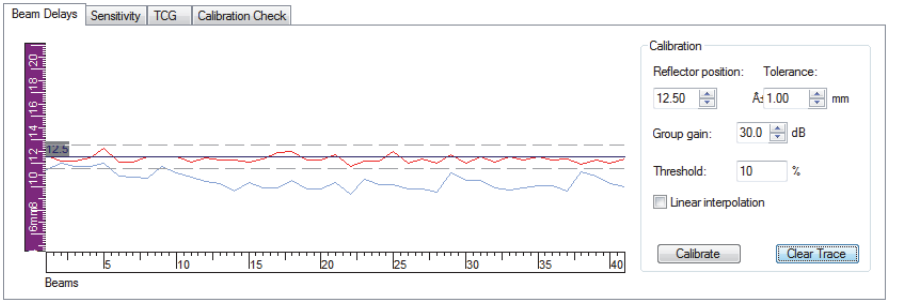

Figure 4-21 Red line appearing between tolerance lines after calibration

10. If the calibration is not successful, repeat steps 6 to 9.
11. If you need to reset the calibration, proceed as follows:

    a) On the Dashboard, click the Calculator button ( ).

    b) In the Calculator, click **Replace**.

4.3.2 Calibrating the Sensitivity

The purpose of the phased array sensitivity calibration is to adjust the gain of each beam so that the amplitude of a known reflector appears at the same level for all beams.

To calibrate the sensitivity

1. On the component toolbar, click (Phased Array Calibration).
2. In the **Phased Array Calibration** dialog box, click the **Sensitivity** tab.
3. Couple the probe to the calibration block and perform a first scan on the calibration block above a reference reflector.

   During the scan, FocusPC draws the distance envelope (blue line) obtained for each beam and constructs a curve (red line) representing the position of the maximum amplitude (Figure 4-22 on page 119).

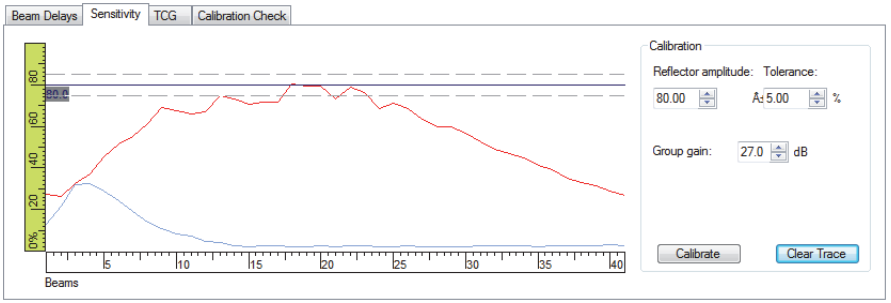

Figure 4-22 Sensitivity example after a first scan

4. In FocusPC, in a Side (B), End (D), or Sector (S) view, position the reference (red) and measurement (blue) cursors respectively above and below the reference reflector of the calibration block (Figure 4-19 on page 116).
5. In the **Phased Array Calibration** dialog box:
   a) Set the **Reflector amplitude** parameter to the amplitude (%) at which you wish to see the reference reflector maximum amplitude appear.
   b) In the **Tolerance** parameter, enter the acceptable amplitude tolerance.
   c) If the reflector echo is too weak or too strong, adjust the **Group gain** parameter.
   d) Click **Clear Trace** to clear the data from the previous scan.
6. Perform a new scan above the reference reflector on the calibration block.
7. Click **Calibrate**.

   FocusPC clears the graph content and calculates the gain for each beam so that the reflector echo amplitude appears at the requested level for all beams.
8. Perform a new scan above the reference reflector on the calibration block to validate the calibration by confirming that the red line appears within the tolerance lines (Figure 4-23 on page 120).

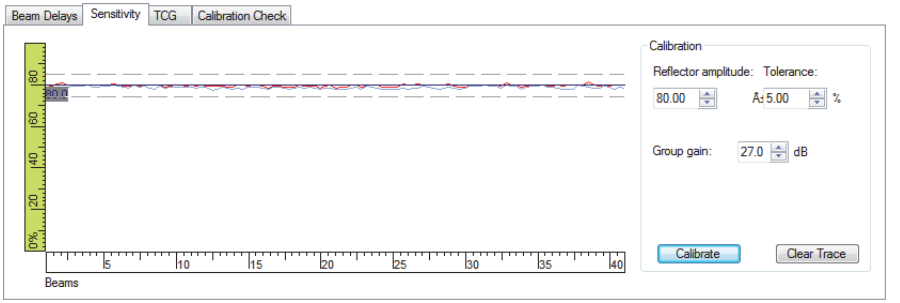

Figure 4-23 Curves for the sensitivity calibration

9. When the calibration is not successful, repeat steps 6 to 8.
10. If you want to review or reset the beam gains:

    a) On the component toolbar, click (UT Settings).
    b) In the **Beam** list above the tabs, select the desired beam.
    c) In the **General** tab, under **Gain**, review or edit the **Beam** gain.
    d) If required, reset the sensitivity calibration by clicking **Reset Beam**.

4.4 Calibrating a Conventional UT Group

You can calibrate the ultrasonic velocity and the wedge delay of a conventional UT group using the parameters available on the **General** tab of the **UT Settings** dialog box (Figure 4-24 on page 120).

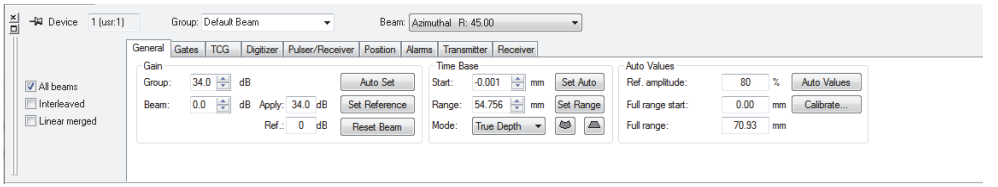

Figure 4-24 General tab of the UT Settings dialog box for a UT group

You need a calibration block with one known reflector to perform the delay calibration and a calibration block with two known reflectors to perform the velocity calibration.

To calibrate a conventional UT group

1. On the component toolbar, click (UT Settings).
2. On the Dashboard, select the conventional UT group that you want to calibrate. If necessary, you can create a new group by clicking the **Add a new group** button ( ) on the Dashboard and selecting the **Conventional UT** option.
3. In the **UT Settings** dialog box, select the probe category and model (Figure 4-25 on page 121).

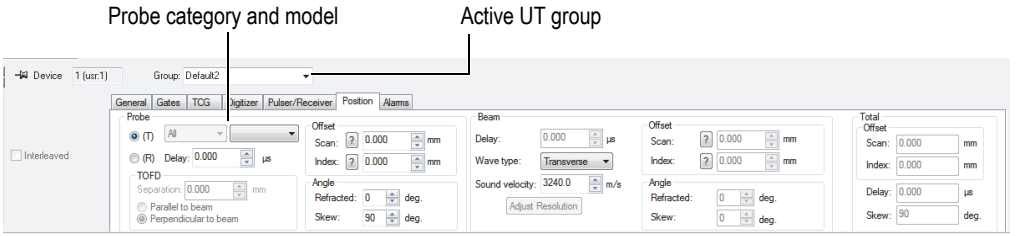

Figure 4-25 Selecting the probe in the UT Settings dialog box

4. Place the probe on the calibration block and position the probe over the two reflectors with known positions.
5. On an A-scan view, proceed as follows:
   a) Select and configure the view to see the echoes of the two reflectors.
   b) Position the Reference cursor (red line) on the echo of the first reflector.
   c) Position the Measurement cursor on the echo of the second reflector.
6. In the **UT Settings** dialog box, on the **General** tab:
   a) Under **Time Base**, set **Mode** to **Half path**.
   b) Under **Auto Values**, click **Calibrate**.
7. In the **Time / Half Path** dialog box that appears (Figure 4-26 on page 122), proceed as follows:
   a) Under **What Do You Want to Compute**, select **Compute Velocity and delay**.

b) Set **Ref. cursor position** to the known position of the first reflector.

c) Set **Meas. cursor position** to the known position of the second reflector.

d) Click **OK**.

FocusPC calculates the ultrasonic velocity and wedge delay and sets the corresponding values in the **UT Settings** dialog box, on the **Position** tab.

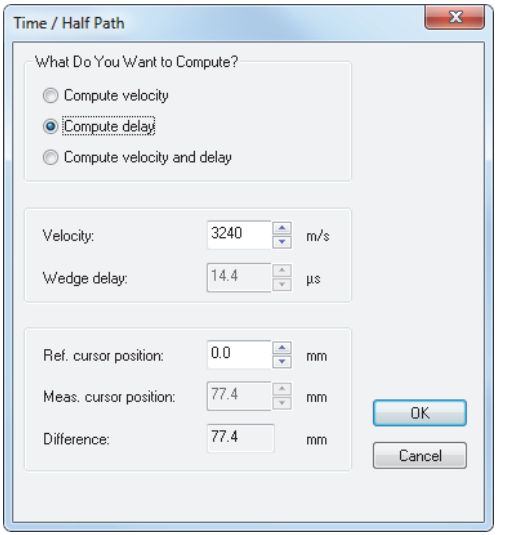

Figure 4-26 Calibrating with the Time / Half Path dialog box

4.5 Calibrating a TOFD Group in Setup Mode

Although TOFD groups are generally calibrated in Analysis mode, the following procedure explains how to calibrate in Setup mode. For more information on how to calibrate a TOFD group in Analysis mode, refer to the *FocusPC Advanced User's Manual*.

To calibrate a TOFD group in Setup mode

1. On the component toolbar, click (add view content) and display the TOFD group A-scan and Side (B) views.
2. In the **UT Settings > General** dialog box, under **Time Base**, set **Mode** to **TOFD**.

3. On the component toolbar, click TOFD to open the **TOFD Manager** dialog box.
4. In the **TOFD Manager** dialog box, click **Calibration**.
5. In the **TOFD** dialog box, proceed as follows:
   a) Under **What Do You Want to Compute?**, define which parameters you want to compute.
   b) Under **Scan axis**, define the scan axis as either **parallel to beam**, or **perpendicular to beam**.
   c) Under **TOFD primary value** and **TOFD secondary value**, define the requested parameters.
   d) Click **OK**.

NOTE

If you select the **Compute velocity and wedge delay** option under **What Do You Want to Compute?** in the **TOFD** dialog box, the measurement cursor has to be positioned on a second reference signal (for example, lateral wave).

The ultrasonic axis is now calibrated in Setup mode.

4.6 Working with Overlay Drawings

An overlay is a graphical representation of weld geometry or of a part that is superimposed over an ultrasonic data view. The overlay helps to visualize where defects are physically located relative to the weld or to the part geometry. FocusPC provides predefined customizable overlays.

For weld inspection applications, you can add a weld drawing as an overlay in the view.

To create a weld overlay

1. On the component toolbar, click (Add Weld), and proceed as follows:
   a) In the **Predefined Weld** dialog box, click the appropriate weld type to open the **Weld Parameters** dialog box (Figure 4-27 on page 124).

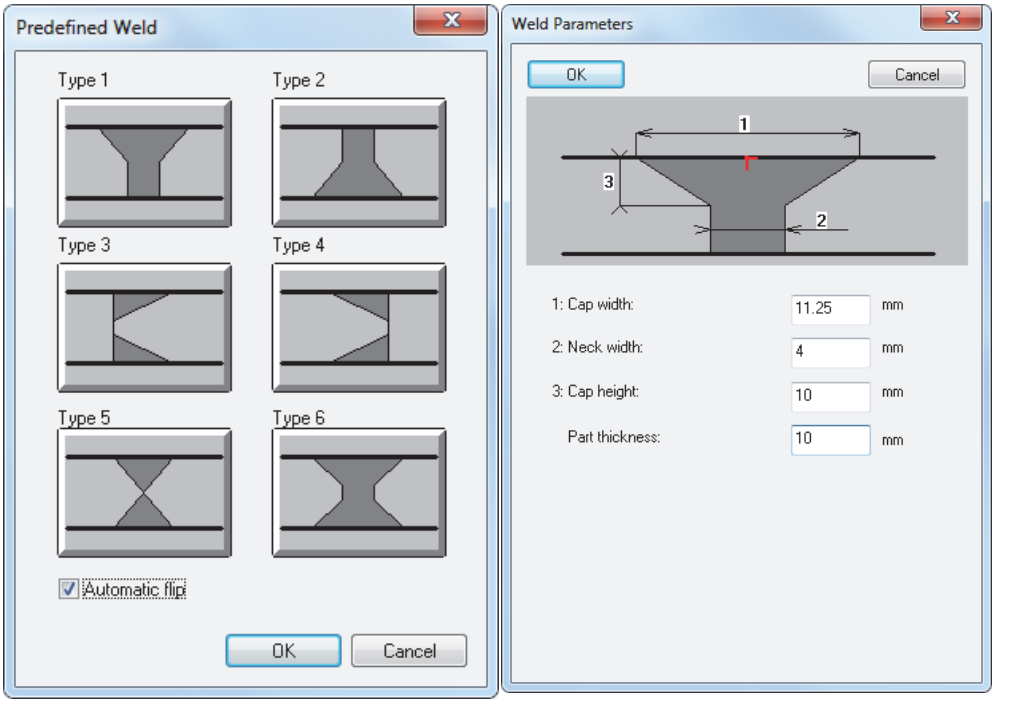

Figure 4-27 Predefined Weld and Weld Parameters (for Type 1) dialog boxes

b) In the **Weld Parameters** dialog box, type appropriate values to define your weld, and then click **OK**.

c) Back in the **Predefined Weld** dialog box, select the **Automatic flip** check box, and then click **OK**.

The weld overlay appears in the view (Figure 4-28 on page 125).

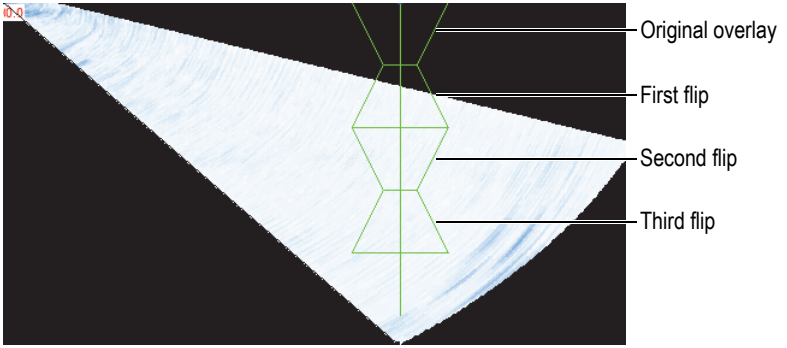

Figure 4-28 Example of a weld overlay with three flips

4.7 Working with the TCG Curve

The time-corrected gain (TCG) function operates by modifying the receiver gain during data acquisition to compensate for the attenuation of the ultrasonic wave in the material. The TCG curve defines gain values that are added to the group gain.

FocusPC offers two methods to construct a TCG curve. For a UT conventional group (mono-element probe) or for a linear 0-degree phased array group, you can use the controls on the **TCG** tab of the **UT Settings** dialog box (see "Constructing a TCG Curve for a Conventional UT Group" on page 125). For a phased array group, use the Phased Array Calibration component (see "Constructing a TCG Curve for a Phased Array Group" on page 129).

In order to build a TCG curve, a calibration block is required with same-sized reflectors at different depths. You can then display the TCG curve as a red line at the top of the corresponding A-scan view (see "Displaying or Hiding the TCG Curve" on page 128).

4.7.1 Constructing a TCG Curve for a Conventional UT Group

Use the controls on the **TCG** tab of the **UT Settings** dialog box to construct a TCG curve for a UT conventional group or for a 0-degree linear phased array group to which the same TCG curve is applied to all laws.

To construct a TCG curve for a conventional UT group

1. Choose a layout that includes an A-scan view.
2. Enable the TCG function:

   a) On the component toolbar, click (UT Settings).

   b) In the **UT Settings** dialog box, click the **TCG** tab, and then select the **Enable** check box (Figure 4-29 on page 126).

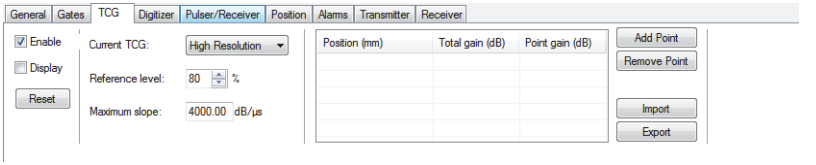

Figure 4-29 TCG tab of the UT Settings dialog box

3. Set **Current TCG** to either **Full Range** or **High Resolution**.

NOTE

Only the **High Resolution** option is available for UT groups on the HD connectors.

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4. Place the probe on a calibration block that has same-sized reflectors at different known depths.
5. Position the probe to get well-defined echoes on the A-scan (Figure 4-30 on page 127).

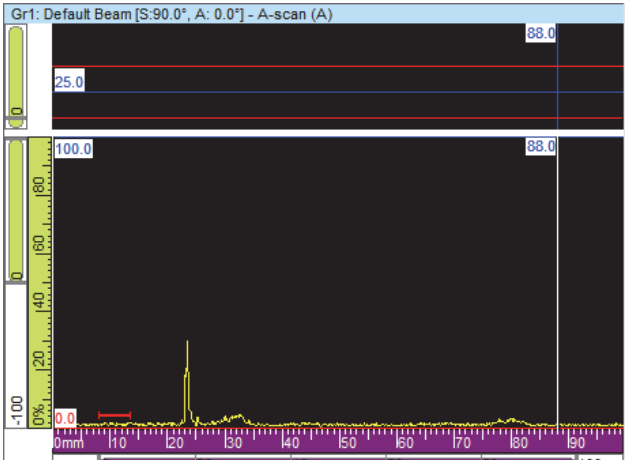

Figure 4-30 A-scan before adding the first TCG point

6. In the **UT Settings** dialog box, set the **Reference level** parameter to the amplitude level for the echo, expressed in percent of the full-screen height. The 80 % default setting is suitable as a basic setting in most cases.
7. On the A-scan view, position the Reference and the Measurement cursors to the left and the right of the echo by double-clicking and double-right-clicking respectively.
8. Maximize the signal amplitude by moving the probe over the indication. Use the envelope tool to help you find the maximum signal.
9. In the **UT Settings** dialog box, click **Add Point** to add the chosen point to the TCG curve. When needed, click **New Line** to add an empty line.

   FocusPC adjusts the gain to bring the peak of the selected echo to 80 % of the full-screen height.

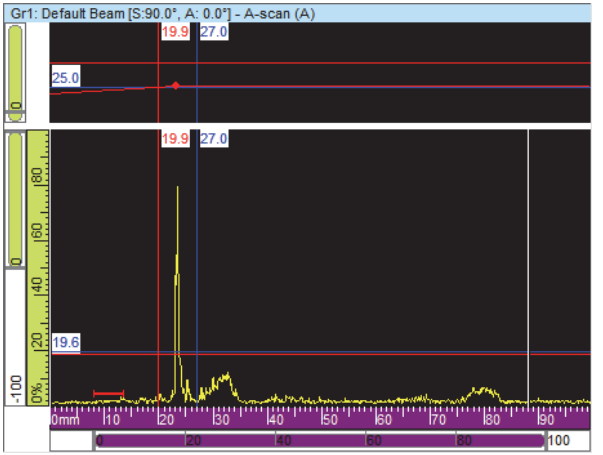

Figure 4-31 A-scan after adding the first TCG point

10. Repeat steps 7 to 9 for each point you want to add to the TCG curve. A minimum of two points is required to define a functional TCG curve.

IMPORTANT

A **Point gain** with a negative value is not applied. Ensure to construct your TCG curve without negative point gains. Point 0 corresponding with the interface is not always the one with the highest amplitude.

4.7.2 Displaying or Hiding the TCG Curve

The TCG curve can be displayed or hidden using the following steps:

To display or hide the TCG curve

1. Select the A-scan view in which you want to display or hide the TCG curve.
2. On the component toolbar, click (UT Settings).
3. In the **UT Settings** dialog box, select the **TCG** tab.
4. Select or clear the **Display** check box to respectively display or hide the TCG curve.

The TCG curve appears as a red line at the top of the corresponding A-scan view.

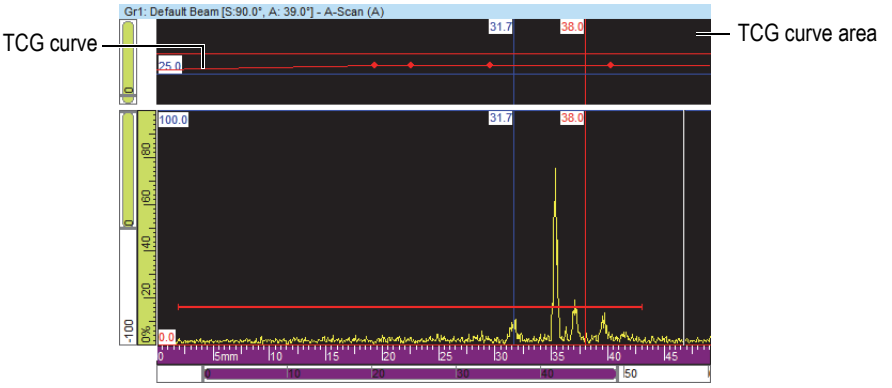

Figure 4-32 Example of an A-scan view showing the TCG curve

4.7.3 Constructing a TCG Curve for a Phased Array Group

Use the controls in the **TCG** tab of the **Phased Array Calibration** dialog box to construct a TCG curve for a phased array group. For angle beam inspections such as in weld applications, you need to use the following procedure to calculate the TCG gain independently for each beam.

To construct the phased array TCG curve

1. Enable the TCG function by proceeding as follows:
   a) On the component toolbar, click (UT Settings).
   b) In the **UT Settings** dialog box, click the **TCG** tab, and then select the **Enable** check box.
2. On the component toolbar, click (Phased Array Calibration).
3. In the **Phased Array Calibration** dialog box, click the **TCG** tab.
4. In FocusPC, in a Side (B), End (D), or Sector (S) view (depends on probe skew), position the Reference (red) and Measurement (blue) cursors respectively above and below the reflector indication (Figure 4-19 on page 116).
5. Place the probe on the calibration block and perform a first scan on the calibration block above one reference reflector.

During the scan, FocusPC draws the amplitude envelope (blue line) obtained for each beam and constructs a curve (red line) representing the maximum amplitude of the envelope (Figure 4-33 on page 130).

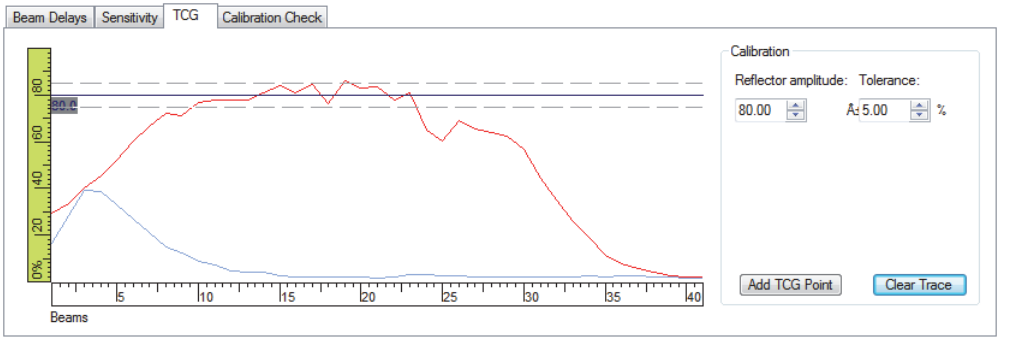

Figure 4-33 TCG curve construction example after a first scan

6. In the **Phased Array Calibration** dialog box, proceed as follows:
   a) Set the **Reflector amplitude** parameter to the amplitude (%) at which you wish to see the reference reflector maximum amplitude appear.
   b) In the **Tolerance** parameter, enter the acceptable amplitude tolerance.
   c) Click **Clear Trace** to clear the data from the previous scan.
7. Perform a new scan on the calibration block.
8. To use this reflector to create a TCG curve point, click **Add TCG Point**.
   FocusPC adjusts the gain for each beam to obtain the required reference amplitude for the depth corresponding to the inspected reflector.
9. Repeat steps 4 to 8 for each reference reflector used to construct the complete TCG curve.

TIP

You can review the TCG gain for each beam on **TCG** tab in the **UT Settings** dialog box.

4.7.4 Importing a TCG Curve

The TCG curve points can be easily imported and exported directly from the FocusPC interface using simple .csv (comma-separated values) files using the following procedure.

To import a TCG curve

1. Create the .csv file containing the different TCG points for a particular group (Figure 4-34 on page 131):
   a) Generate a line for every beam using the following structure where the **Positions** are defined in mm and the **Gains** are in decibels. Every number is entered with a three digits decimal precision.

   Position 1, Gain 1; Position 2, Gain 2;....

   b) Add comments at the end of every line as long as they are preceded by a "#" symbol.
   c) Save or rename the file as a **.csv** file to be interpreted correctly.

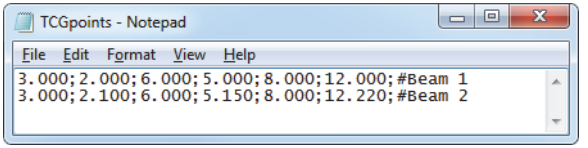

Figure 4-34 TCG points import text

2. On the Dashboard, select the group to which you want to apply the TCG points.
3. On the **TCG** tab of the **UT Settings** dialog box:
   a) Click **Import**.
   b) Select the .csv file containing the TCG points.
   c) Click **Open**.

NOTE

The TCG point positions may differ from the ones defined in the .csv file if the positions defined in the .csv file do not match the available TCG point-position slots.

4.8 Working with Layouts

In FocusPC, a layout is an organization of two or more views appearing in the window. FocusPC offers a set of ten layouts available on the Dashboard for quick selection (Figure 4-35 on page 132).

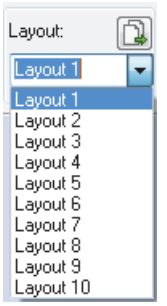

Figure 4-35 Set of ten layouts

4.8.1 Applying a Template Layout File

FocusPC comes with a certain number of template layout files each containing up to ten layouts that can be selected to modify the current display. Additional layout files can also be created and defined as template layout files (see “Saving Layout Files and Defining New Template Layouts” on page 134 for more information).

To apply a template layout

1. On the Dashboard, click to select a Template layout file.
2. From the list of available layouts, choose the most appropriate (Figure 4-36 on page 133).

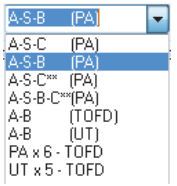

Figure 4-36 List of available layouts

4.8.2 Displaying or Changing the View in a Pane

After a layout has been selected, the views can be modified in order to customize the display.

To change the view in a pane

1. Activate the pane you want by clicking anywhere in it.
2. Click on the component toolbar (or press SHIFT+ENTER) to open the **Contents** dialog box (Figure 4-37 on page 133).

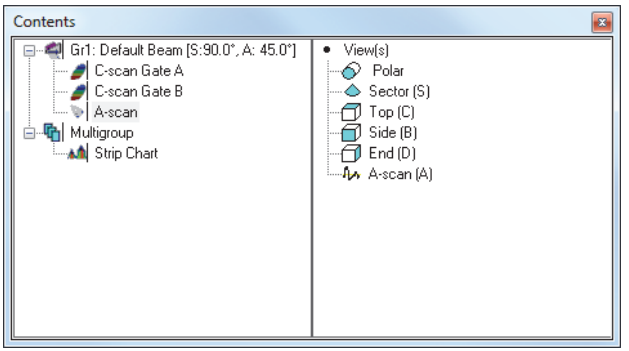

Figure 4-37 Example of the Contents dialog box

3. Double-click the view type to display it in the active pane.
4. If required, activate another pane by clicking it, and then select the data and the view to be displayed in this pane.

The right section is updated to list the view types that are possible with the selected data type.

4.8.3 Saving Layout Files and Defining New Template Layouts

The list of template layouts described in "Applying a Template Layout File" on page 132 matches the content of the layout folder. The default layout folder is [Installation Folder]\FocusPC*nnn*\Layouts Files. You can customize the list of predefined layouts by adding, removing, or modifying the layout files and their subfolders.

IMPORTANT

Do not modify or delete the following layout files:

[Installation Folder]\FocusPC*nnn*\Layout Files\Viewer.rst

[Installation Folder]\FocusPC*nnn*\Layout Files\Composite\Composite.rst

[Installation Folder]\FocusPC*nnn*\Layout Files\Weld\Weld.rst

Changing or deleting the Viewer.rst file prevents the FocusPC Viewer edition from starting up. If this occurs, reinstall FocusPC to fix the problem.

To save a set of ten customized layouts

1. On the main menu bar, click **File > Save As**.
2. In the **Save As** dialog box that appears (Figure 4-38 on page 135), proceed as follows:
   a) Select **Displays Setup (*.rst)** in the **Save as type** box.
   b) Enter the **File Name** for the .rst file.
   c) Click **Save**.

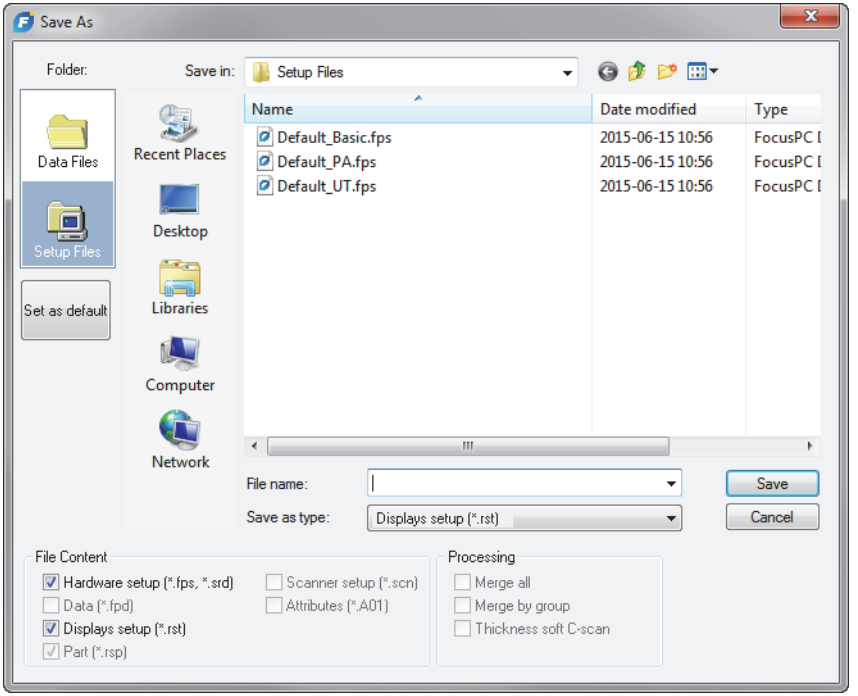

Figure 4-38 Save As dialog box

4.9 Working with the Readings

FocusPC computes reading values for various parameters for analyzing ultrasonic data. Readings are calculated using cursor, zone, or acquisition parameters and can be displayed at the top of a view (Figure 4-41 on page 138).

4.9.1 Reading Management

You can define four groups of readings using the readings **Information Groups** dialog box (Figure 4-39 on page 136). You can access the **Information Groups** dialog box by double-clicking in the reading zone at the top of a view.

The most frequently used readings are organized by categories under **Favorite Readings** in the **Information Groups** dialog box. Each category has a limited number of readings with short names. The categories and lists of available readings are the same for each of the four groups and for all view types.

More readings are available from the **Information Groups** dialog box when Expert mode is activated (see “Expert Mode” on page 93 for details).

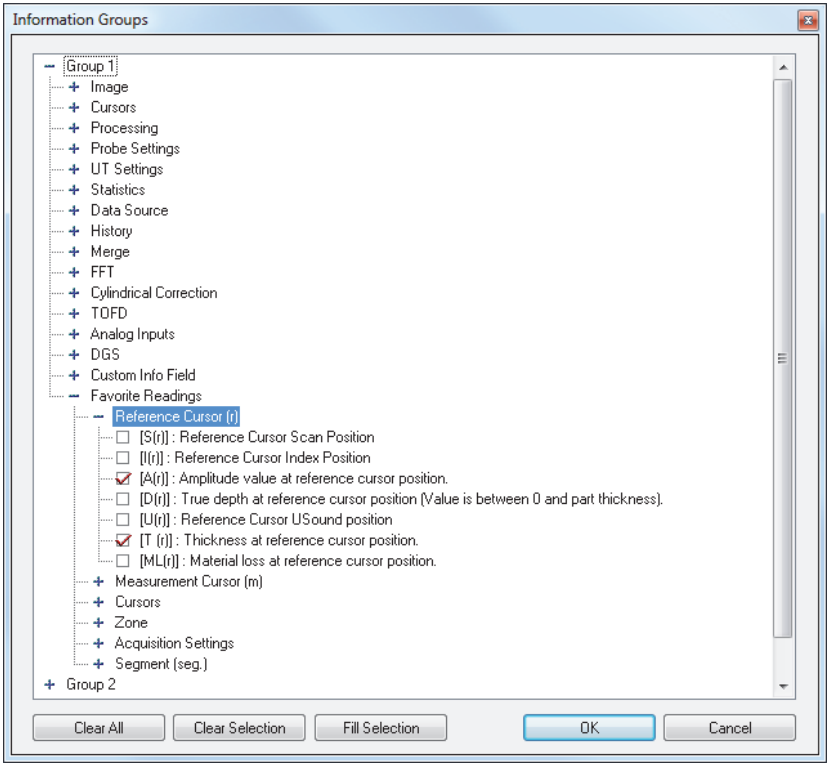

Figure 4-39 Information Groups dialog box — Favorite Readings categories

The reading configuration is saved in an .rst file that is included by default in the .fps file (see “File Formats” on page 94 for details).

4.9.2 Reading Examples

The following readings, illustrated in Figure 4-40 on page 137, provide useful numerical values for an indication's amplitude and position within the inspected part:

A(r)

The amplitude (%) at the reference cursor position.

D(r)

The true indication depth (always between zero and the part thickness) at the reference cursor position.

T(r)

The thickness at the reference cursor position.

U(r)

The position of the reference cursor on the ultrasonic axis (expressed in time of flight [µs], half path [mm] or true depth [mm]).

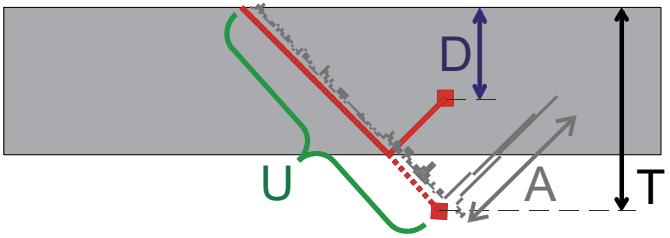

Figure 4-40 Illustration of the A, D, T, and U readings

The following readings provide useful information for corrosion applications:

ML(r)

Material loss (%) at the reference cursor position

T(Zmin)

Minimum thickness inside the zone

S(ZMin)

Position of the minimum thickness inside the zone on the scan axis

I(Zmin)

Position of the minimum thickness inside the zone on the index axis

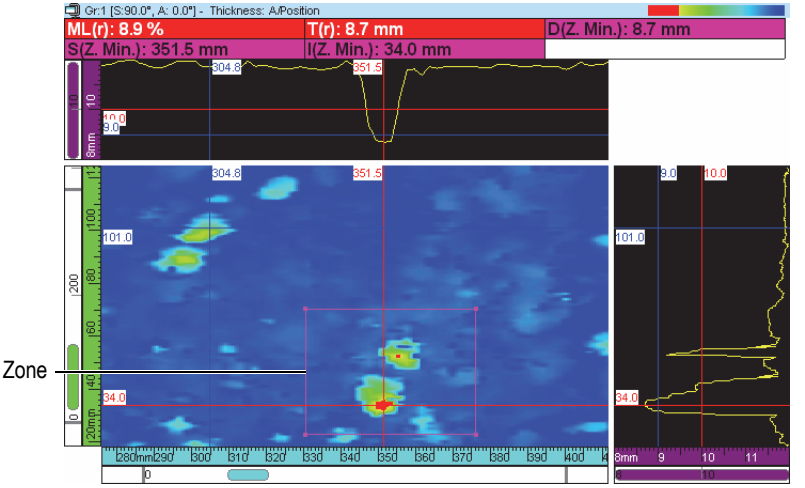

Figure 4-41 Example of corrosion readings

When you position the pointer over a reading, a tooltip appears, providing a useful definition of the reading (Figure 4-42 on page 138).

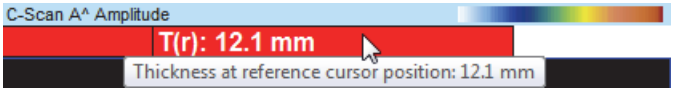

Figure 4-42 Example of a reading tooltip

You can display all readings in all views. However, a value only appears when the measurement can be computed in the view. For example, with an A-scan view, the amplitude value can be computed and displayed but not a zone value (Figure 4-43 on page 138).

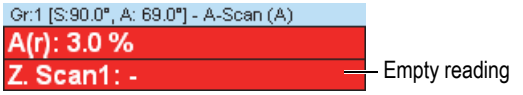

Figure 4-43 Example of an empty reading

4.9.3 Hiding or Showing Readings at the Top of a View

You can quickly hide or show readings configured to appear at the top of a view.

To hide or show a specific reading group at the top of a view

1. Select the view you want to modify.
2. On the component toolbar, select , , , or to hide or show a specific reading group.

To hide or show all the readings at the top of a view

1. Right-click the title bar of the view.
2. In the shortcut menu, select or clear **Show Info Group**.

4.10 Working with Gates

The following steps describe how to configure the gates. This procedure must be independently performed for every group. For reference information on the **Gates** tab, refer to the FocusPC *Advanced User's Manual*.

To define gates

1. On the component toolbar, click (UT Settings).
2. If not already done, display an A-scan view on the active pane.
3. In the **UT Settings** dialog box, click the **Gates** tab and proceed as follows:
   a) Position the vertical reference and measurement cursors on the ultrasonic axis, by double-clicking and double-right-clicking, so as to determine the starting position and length of the gate.
   b) Position the horizontal reference cursor on the amplitude axis so as to determine the detection threshold level of gate 1.
   c) Click **Set Gate** button.
   d) Select the check box to the left of the corresponding gate to enable the creation of a data group, thereby enabling recording of the position and amplitude of the C-scan data.
   e) Select the **POS B - POS A** check box to enable the creation of a data group monitoring the position difference between Gates A and B.

4.10.1 Gate Adjustments

You can adjust the position and the width of a gate. In the A-scan, this is done by dragging-and-dropping a part of the gate line. The mouse pointer changes depending on where you click the gate line, and indicates the task that you can perform (Table 4 on page 140).

Table 4 Moving and resizing a gate using the mouse

Task	Pointer	Action
To resize a gate		Drag-and-drop the end of the gate line
To move a gate		Drag-and-drop the middle part of the gate line
To move a gate vertically only		Press and hold the SHIFT key, and then drag-and-drop the middle part of the gate line
To move a gate horizontally only		Press and hold the CTRL key, and then drag-and-drop the middle part of the gate line

You can precisely configure the gates by clicking , and then using the parameters on the **Gates** tab of the **UT Settings** dialog box (Figure 4-44 on page 140).

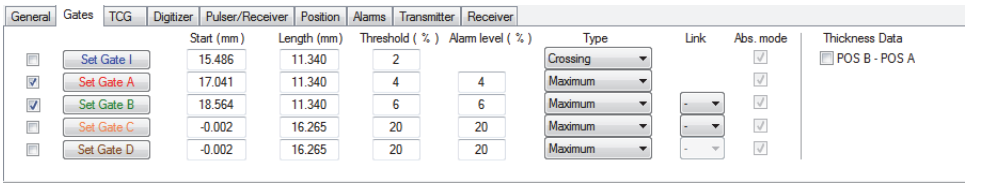

Figure 4-44 Gates tab of the UT Settings dialog box

4.10.2 Gate Synchronization

Synchronizing gates means that the start position of a gate depends on the start position of another gate. For example, when gate B has a start position of 10 mm and is synchronized with gate A, gate B starts 10 mm on the right of the start of gate A.

Synchronizing gates is useful, for example, in an immersed inspection where the distance between the probe and the inspected part fluctuates in time. Using gate I to detect the interface echo, and then synchronizing gate A on gate I ensures that gate A always captures echoes from the same position range in the immersed inspected part.

You can only synchronize the position of a gate with the position of the previous gate. For example, gate A can only be synchronized with gate I, gate B can only be synchronized with gate A and so forth.

To synchronize a gate on another gate

1. To synchronize the A-scan starting position on gate I, set **Synchro**. to **Echo (On I/)** on the **Digitizer** tab of the **UT Settings** dialog box.
2. To synchronize other gates, set **Link** to the desired value on the **Gates** tab of the **UT Settings** dialog box.

When FocusPC acquires data, you can also specify a negative start position for a gate that is synchronized on another gate. This allows you to create anticausal or presynchronization detection. This feature is useful when you need to detect a weak echo appearing just before a strong echo. Presynchronization is possible because the FOCUS PX can generate up to 10 µs of signal prior to a gate. Note that while more than one pair of gates can use presynchronization, you cannot synchronize a gate to a synchronized gate that has a negative start position.

4.10.3 Gates in Analysis Mode

You can also adjust the gate position and size in Analysis mode. The modified data is saved in a companion file (.A01). You can easily come back to the original gate parameter values by right-clicking the title bar of the view and then selecting **Restore Initial Gates** on the shortcut menu.

NOTE

In Analysis mode, when you move a gate on an A-scan or S-scan view while the ultrasonic axis is in true depth, the new gate position is calculated in true depth. However, when you move the a gate on an A-scan view while the ultrasonic axis is not in true depth, the new gate position is calculated in sound path.

In Analysis mode, when programmed in Half-Path mode, the gated zone on the S-scan is only for the current beam. The position of the gate limits are automatically adjusted on the S-scan when you change the current beam (Figure 4-45 on page 142).

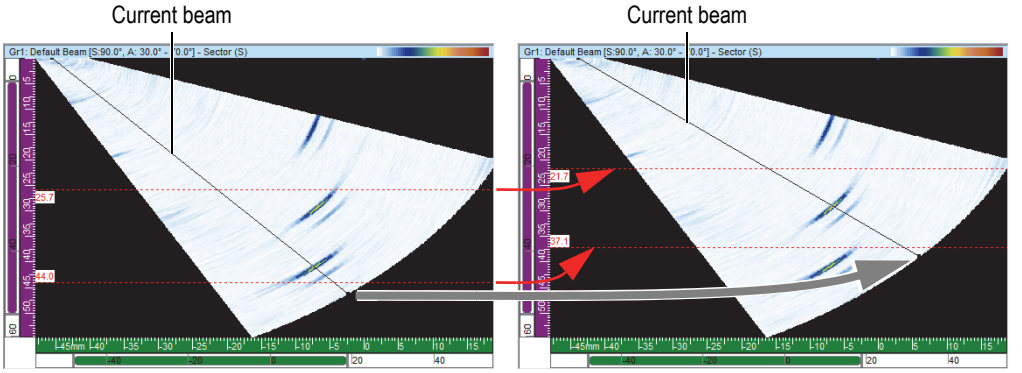

Figure 4-45 Automatic adjustment of the S-scan gate position

4.10.4 Gates and Amplitude C-Scans

You can configure FocusPC to acquire data below the gate level by selecting the **Always record amplitude in acquisition** option in the **Preferences** menu. This option is activated (selected) by default. If this option is not selected, data under the gate level will not be acquired.

To configure FocusPC to show data below the gate level in acquisition

1. Select **File > Preferences**.
2. Under **C-Scan** on the **General Settings** tab, select the **Always record amplitude in acquisition** check box.

If you are in Analysis mode after moving the gate, you can also configure FocusPC to show this signal (Figure 4-46 on page 143) by repeating the above procedure and selecting the **Always record amplitude in analysis** check box.

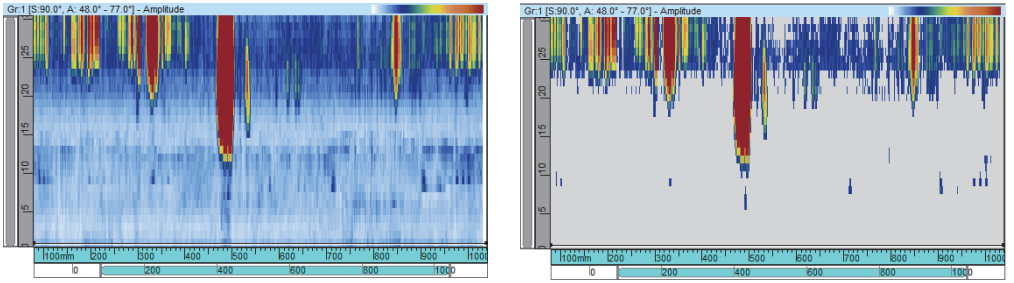

Figure 4-46 Example of a C-scan with and without data below the gate

4.10.5 Gate Usage Example

A water immersion inspection is a good way to illustrate the use of multiple gates (Figure 4-47 on page 143). Position and size gate I over the area where you expect to find the echo from the part interface. Position gate A to cover the path inside the inspected part without detecting the entry and back wall echoes. Finally, position and size gate B over the area where you expect to find the back wall echo. In an immersion inspection, the distance between the probe and the part often fluctuates. To compensate for this fluctuation, the start position of gate A and gate B can be set to automatically change according to the position of the echo detected in gate I. This ensures that both gates constantly cover appropriate areas.

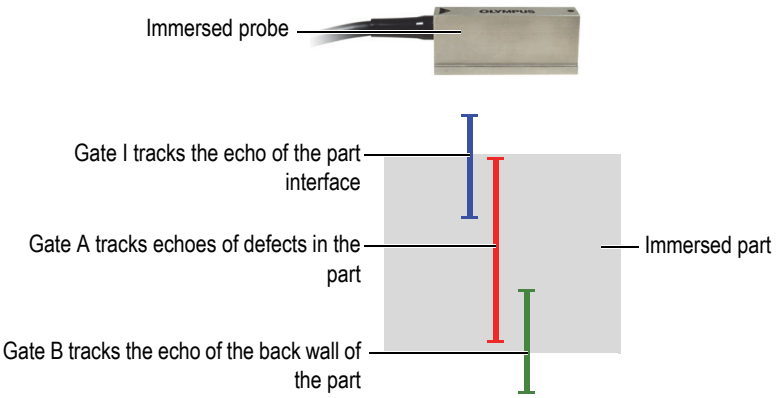

Figure 4-47 Example of gate usage in a water immersion inspection

4.11 Working with the Alarms

The following procedure describes how to define the alarms. For reference information on the **Alarms** tab of the **UT Settings** dialog box, refer to the *FocusPC Advanced User's Manual*.

To define the alarms

1. On the component toolbar, click (UT Settings).
2. On the **Alarms** tab of the **UT Settings** dialog box, proceed as follows:
   a) In the **Output line** list, select the alarm output line.
   b) Under **Conditions**, define the alarm condition by selecting the appropriate options.
   c) Repeat these steps for each alarm condition.

   A set of indicators (Figure 4-48 on page 144) appears in the status bar representing the state of each alarm.

Figure 4-48 Alarm state indicators

4.12 Working with the Firing Sequencer

The **Firing Sequencer** dialog box is used to modify the order in which the ultrasonic beams are fired. For some applications, modifying the firing sequence can help reduce the effects of ghost echoes due to high recurrence.

For a phased array setup with multiple focal laws and channels, the firing repetition (recurrence) is very important to maximize the scanning speed without the presence of interference echoes. This can be critical for immersion techniques with the presence of signals coming from the water surface.

To activate the Firing Sequencer

1. On the component toolbar, click (UT Settings).
2. In the **UT Settings** dialog box, select **Interleaved**.

3. On the component toolbar, click the **Firing Sequencer** button ( ).

   The **Firing Sequencer** dialog box appears, which contains the list of all beams included in the different groups.

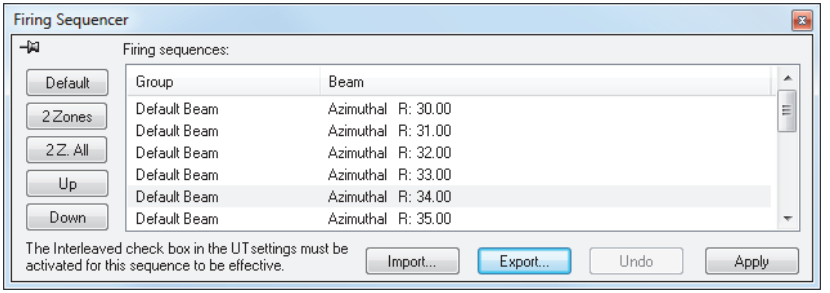

Figure 4-49 Firing Sequencer (Interleave) dialog box

The following describes the buttons of the **Firing Sequencer**, which can be used to modify the firing order of the different beams.

Default

Brings the firing sequence order back to the default sequence (Group 1 - Beam 1, Group 1 -Beam 2, …, Group 2 - Beam 1, Group 2 - Beam 2, and so on).

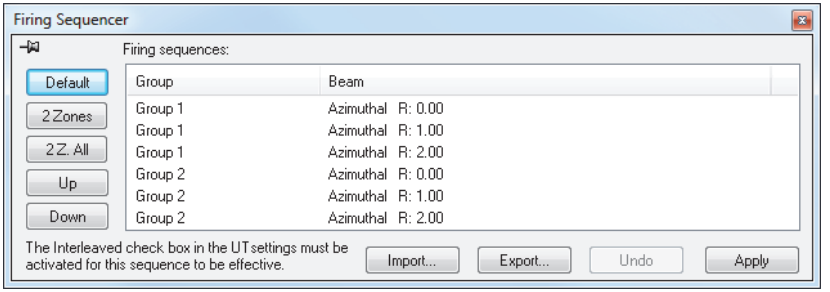

Figure 4-50 Default button

2 Zones

Creates a firing sequence with interlacing pairs of beams within each group (see example in Figure 4-51 on page 146).

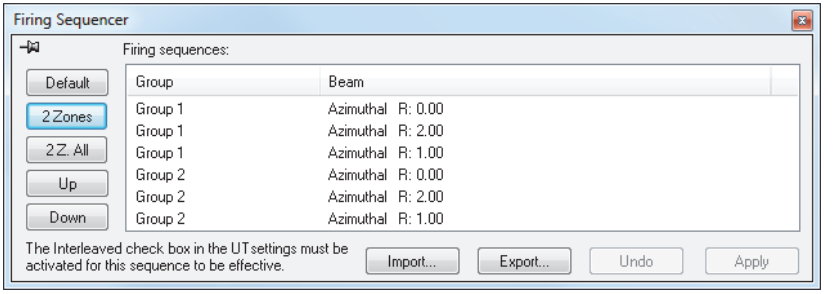

Figure 4-51 Example of firing sequence with 2 Zones interlacing pairs

2 Z. All

Creates a firing sequence with interlacing pairs of beams within all groups (see example in Figure 4-52 on page 146).

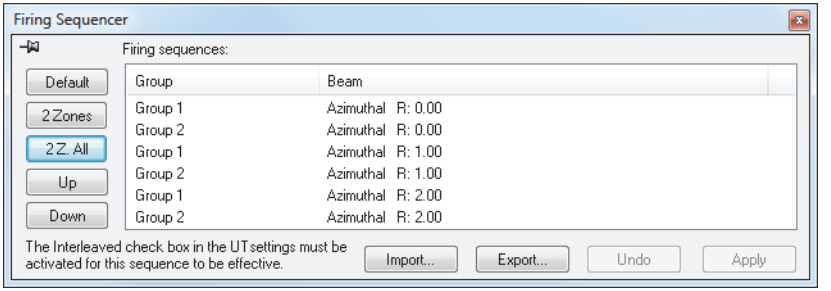

Figure 4-52 Example of firing sequence with 2 Z. All interlacing pairs

Up

Moves the selected beam or group of beams up in the **Firing sequences** list.

Down

Moves the selected beam or group of beams down in the **Firing sequences** list.

Import

Allows you to import a .cfs file containing a firing sequence from a previously exported configuration.

Export

Allows you to save the current firing sequence to a .cfs file.

4.13 Working with the Conditional A-Scan

When the Conditional A-scan feature is activated, A-scans are only recorded when an alarm has been triggered. This ensures that only A-scans of important areas are stored, which enables much larger areas to be scanned in a single inspection.

To set the conditional A-scan

1. Click the **Digitizer** tab of the **UT Settings** panel, and then select the **Conditional** check box. See Figure 4-53 on page 147.

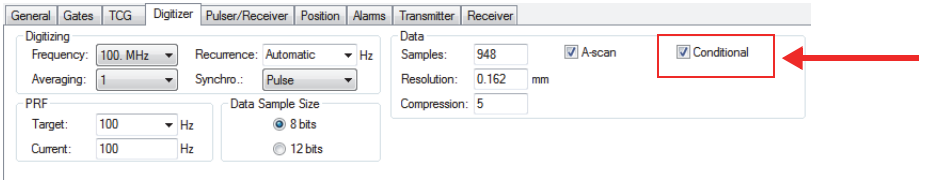

Figure 4-53 Digitizer tab

2. Click the **Alarms** tab of the **UT Settings** dialog box, configure the alarms that will trigger A-scans to be recorded; four different alarms can be configured, all of which will have the same effect. See Figure 4-54 on page 147.

   In the **Count before Alarm** box, you can set the number of consecutive times the alarm condition must be exceeded before the alarm is triggered.

Figure 4-54 Alarms tab

3. Click to start an acquisition.

   A-scans will only be recorded in the areas where an alarm was triggered, as seen in the following figures: Figure 4-55 on page 148 and Figure 4-56 on page 148.

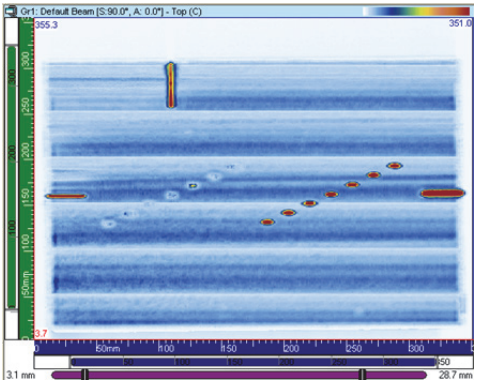

Figure 4-55 Acquisition with full A-scan recording

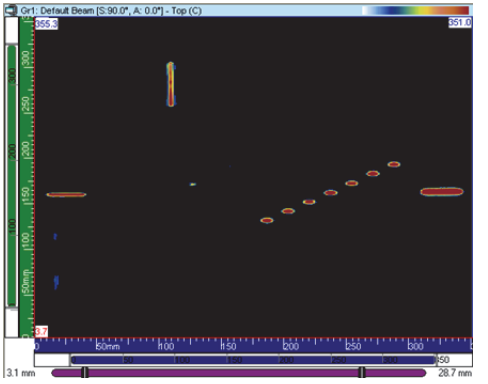

Figure 4-56 Acquisition with conditional A-scan recording

4.14 Working with CAF Groups

The CAF group is in most respects the same as a phased array group with two differences:

- Setup of the synchronization gate (required for the algorithm calculations).
- Activation of CAF and selection of the surface type.

The CAF algorithm is best used with a group of 32 elements. You must use the center elements of a CAF group with at least six beams around the center.

To set the CAF group

1. On the component toolbar, click (**UT Settings**).
2. Set the digitizing range to see the targeted surface. If you are using a curved surface, ensure that the center of the curve is located on the middle elements of the probe. This will be critical for the algorithm to be as efficient as possible.
3. If you are using a surface that does not vary along the scan trajectory, you can use the same reference to set the beginning and end of the gate. If the surface varies along the scan line, use positions R1 and R2 (Figure 4-57 on page 149) as references for steps 4. on page 126 to 9. on page 153. In the illustration, the radius of the curvature is smaller at R1 than at R2.

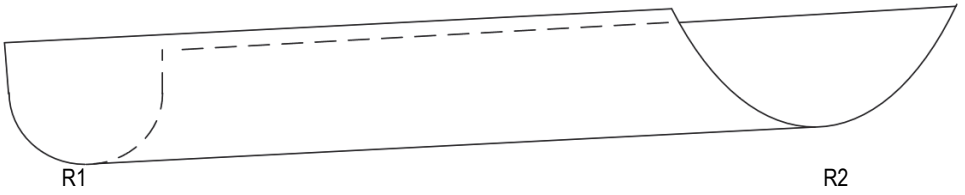

Figure 4-57 R1 and R2 positions

TIP

When setting the gates, keep in mind the following:

- The CAF algorithm works better when going from a flat to concave signal. Avoid convex signal to get good results.
- Remember that the CAF algorithm uses the data in the interface gate to recalculate delays.
- The images given as a reference given in this procedure are examples of a target with varying geometry. If the geometry does not change, use the same reference to set both the beginning and end of the interface gate.
- Set the gates wider than the signal as a tight interface gate will limit the efficiency of the algorithm.

---

4. Place the probe on the sample at the R1 position as in Figure 4-57 on page 149. If the sample shape does not vary, use any clean position on the sample.
5. Align the probe on the sample to get good concentricity. When the probe is concentric with a curved sample, the signal appears flat like in Figure 4-58 on page 151.

NOTE

If the geometry is curved, remember to ensure that the middle elements of the probe are centered on the centerline of the curve. If the part has varying geometry, it might be best to move the probe to the R2 position to ensure it is centered on the curve and then return to R1 before continuing to the next step.

---

6. At that position, set the beginning of the interface gate (Figure 4-58 on page 151).

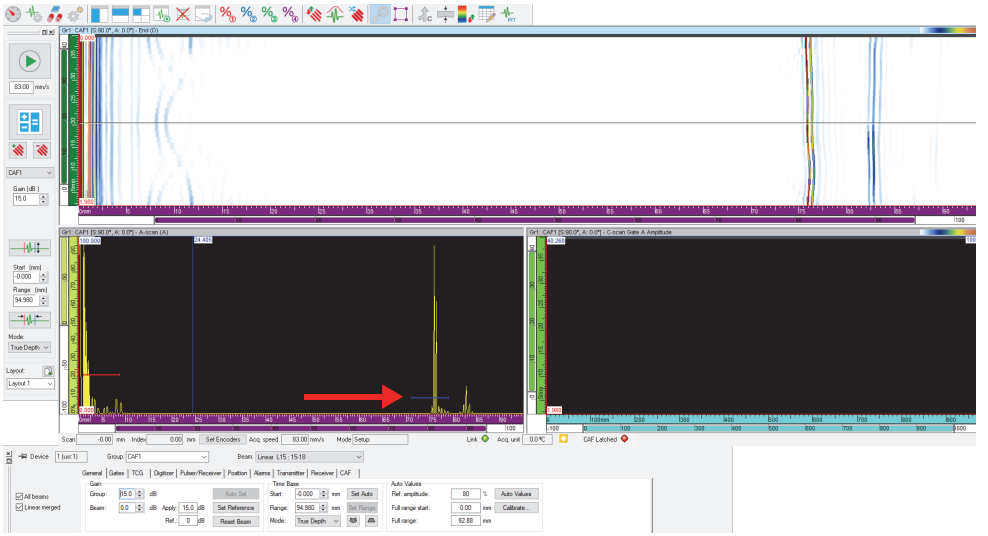

Figure 4-58 Setting the beginning of the interface gate

NOTE

Only the position of the interface gate is relevant, not the height synchronization gate. It is recommended to set the gate threshold very low.

7. If the sample geometry varies, go to the R2 position (Figure 4-58 on page 151). Set the end of the interface gate (Figure 4-59 on page 152).

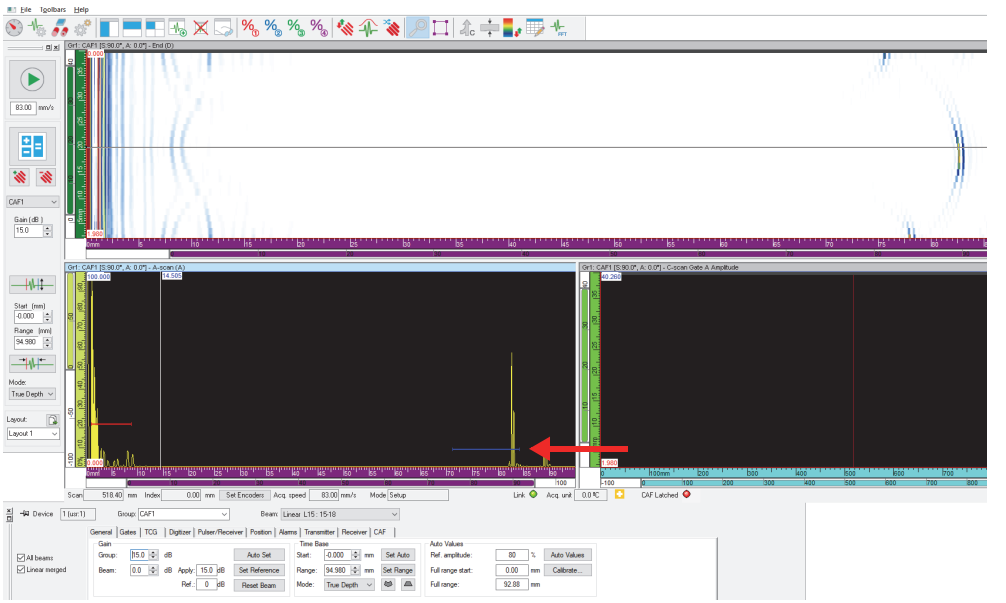

Figure 4-59 Setting the end of the interface gate

8. On the **CAF** tab (in **UT Settings**), select the **CAF Enabled** check box, and then select the surface type (Figure 4-60 on page 153).

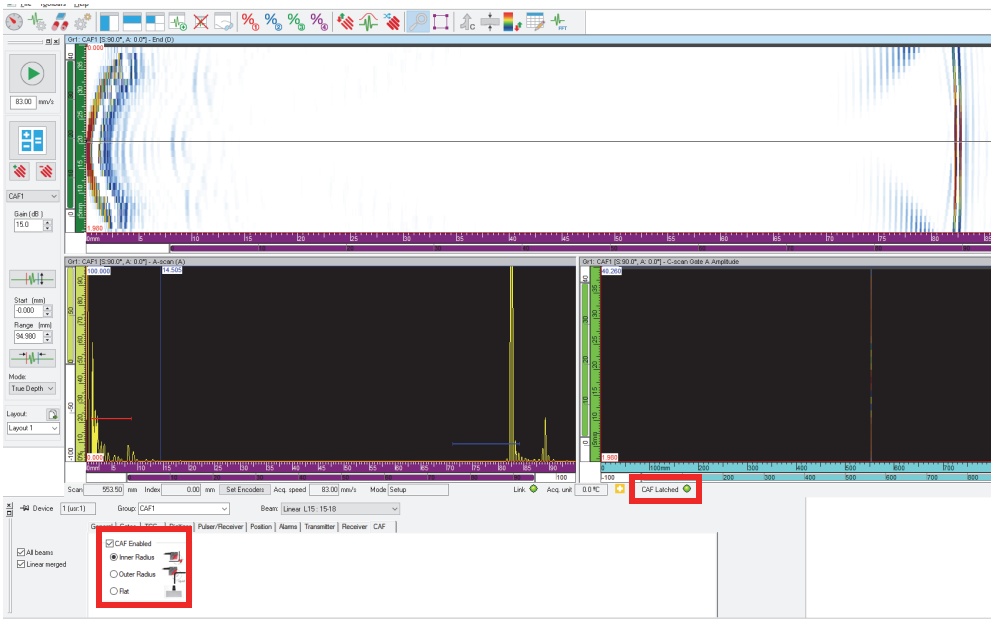

Figure 4-60 Selecting and enabling the CAF type

NOTE

The “CAF Latched” status turns green when the algorithm has converged on the surface.

9. Select **UT Settings > Digitizer**, synchronize (Figure 4-61 on page 154) the CAF group with the algorithm, and then set the UT range.

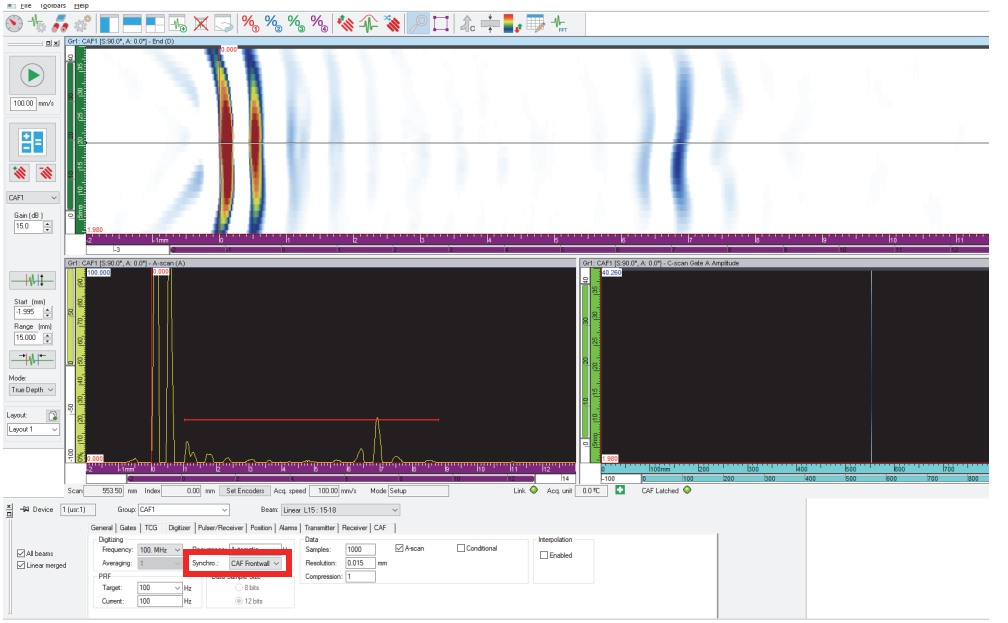

Figure 4-61 Synchronized CAF

5. Performing Acquisitions

To simplify scan configuration, FocusPC offers predefined scan types with typical values. You only have to enter the inspected area's dimensions and set the parameters of your mechanical system. You can also modify the predefined scans as needed, or define custom scans.

5.1 Working with the Different Scan Types

FocusPC has several types of available scans: One-line scan, Free running, Bidirectional, Unidirectional, Helicoidal, Angular, and Custom.

These different scan types are explained in the following sections.

5.1.1 One-Line Scan

The One-line scan type is a linear scan. One position encoder is used to determine the position during the acquisition.

The linear scan (Figure 5-1 on page 156) is unidimensional and proceeds along a linear path. The only settings that must be provided are the limits along the scan axis and the spacing between acquisitions.

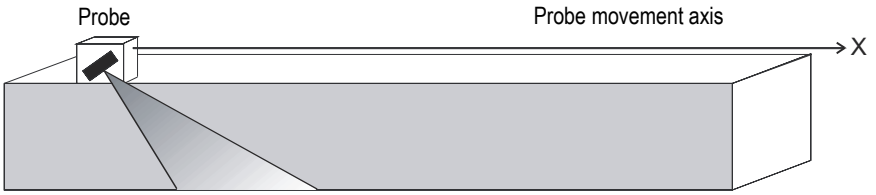

Figure 5-1 Linear scan

Operation mode

The One-line scan operates as follows:

1. The scanner proceeds to the position set in the **Scan: Start** box of the **Scan** tab.
2. The scanner then moves on the scan axis to the position set in the **Scan: Stop** box, while performing data acquisition.
3. Data acquisition is performed at every interval set in the **Scan: Resolution** box.
4. The scan is finished when the scanner has reached the position set in the **Scan: Stop** box.

Description of the Scan tab

When you select **One-line scan** type, the **Scan** tab in the **Scan and Mechanical Settings** dialog box contains the set of options shown in Figure 5-2 on page 156.

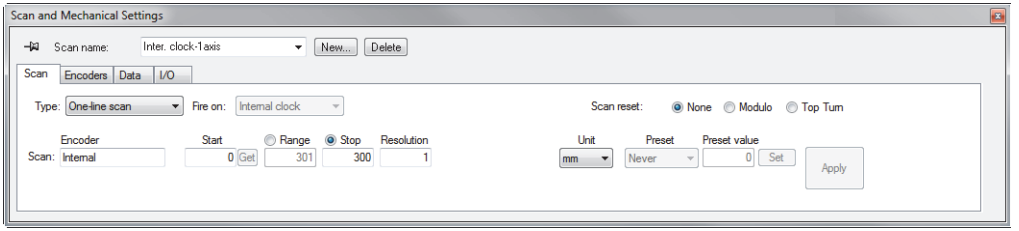

Figure 5-2 Scan tab for the One-line scan type

The **Scan** tab for a One-line scan contains the same options as for a Bidirectional scan except that it does not include the settings for the index axis.

5.1.2 Free Running Scan

With the Free Running scan, data acquisition is performed at the rate specified in the **PRF** box of the **Digitizer** tab (**UT Settings** dialog box). For FocusPC, the data is recorded at only one position, at the origin of the scan and index axes.

Description of the Scan tab

When you select the **Free Running** scan type, the **Scan** tab contains no options or parameters (Figure 5-3 on page 157).

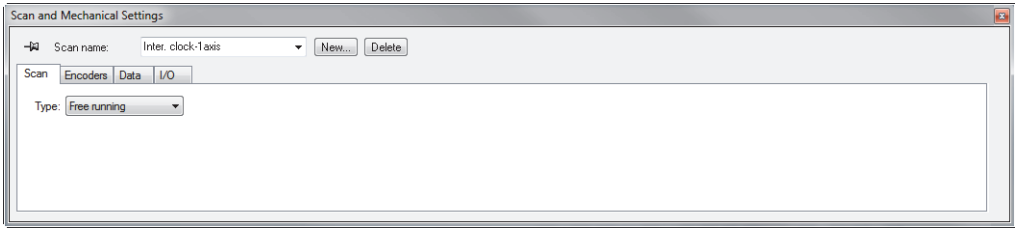

Figure 5-3 Scan tab for Free Running scan

5.1.3 Bidirectional Scan

The Bidirectional scan type is a bidimensional surface scan (also known as a raster scan) in which two encoders are used to determine the position on the scan and index axes during acquisition.

A surface scan uses two axes: (1) the scan axis, which is the mechanical axis of the scanning lines, and (2) the index axis, which is the mechanical axis of movement between the scanning lines. At the end of each scan along the scan axis, an increment is added to the position along the index axis. Data acquisition for bidirectional scans is carried out in both the forward and backward directions along the scan axis, as shown in Figure 5-4 on page 158.

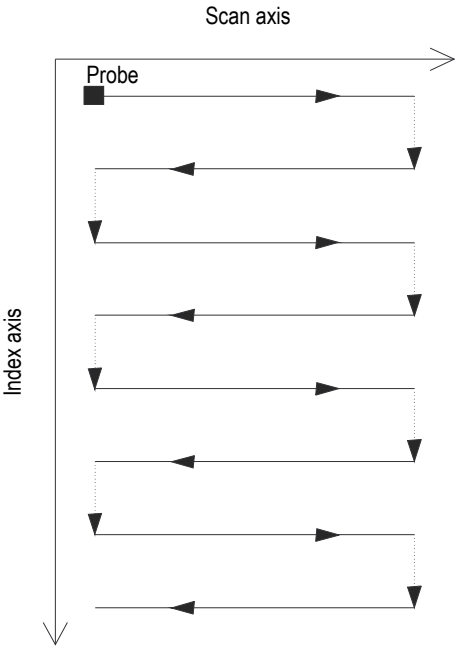

Figure 5-4 Bidirectional surface scan

The user must supply the limits of the inspection surface as well as the spacing between acquisitions. Figure 5-5 on page 159 shows the scan-axis and index-axis parameters in the reference system of the scanning mechanism.

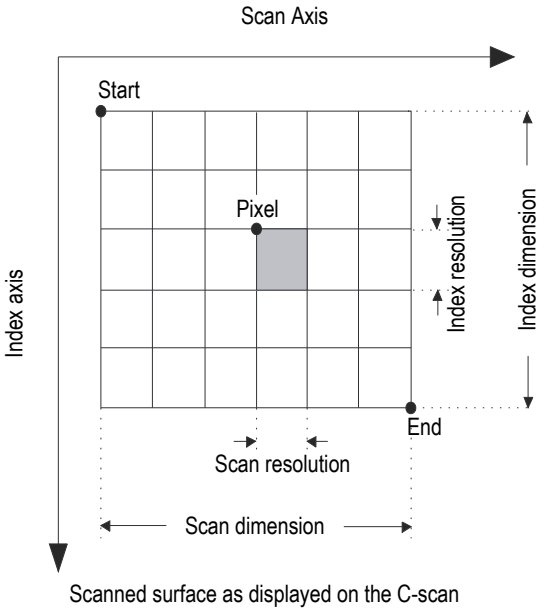

Figure 5-5 Reference system of the scanning mechanism

Operation mode

The Bidirectional scan operates as follows:

1. The scanner proceeds to the **Scan: Start** position set on the **Scan** tab.
2. The scanner proceeds to the **Index: Start** position set on the **Scan** tab.
3. The scanner then moves on the scan axis to the position set in the **Scan: Stop** box, while performing data acquisition.
4. Data acquisition is performed at every interval of the **Scan: Resolution** value set on the **Scan** tab.
5. The scanner moves on the index axis for the distance set in the **Index: Resolution** box.
6. The scanner moves to the **Scan: Start** position, while performing data acquisition.
7. The scanner moves on the index axis for the distance set in the **Index: Resolution** box.
8. The scanner then moves on the scan axis to the position set in the **Scan: Stop** box, while performing data acquisition.

9. Steps 4 to 7 are repeated until the scanner has reached the position set in the **Index: Stop** box. Then, the scan is finished when the scanner has reached the position set in the **Scan: Stop** box (if the index axis has an odd number of steps), or when it has reached the **Scan: Start** position (if the index axis has an even number of steps).

5.1.4 Unidirectional Scan

The Unidirectional scan type is a bidimensional surface scan (also known as a raster scan) in which two encoders are used to determine the position during the acquisition.

A surface scan uses two axes: (1) the scan axis, which is the mechanical axis of the scanning lines, and (2) the index axis, which is the mechanical axis of movement between the scanning lines. At the end of each scan along the scan axis, an increment is added to the position along the index axis. Data acquisition for unidirectional scans is only carried out in one direction along the scan axis, as shown in Figure 5-6 on page 161. This type of scan is typically used with scanning mechanisms that have backlash (free play) in the scan direction.

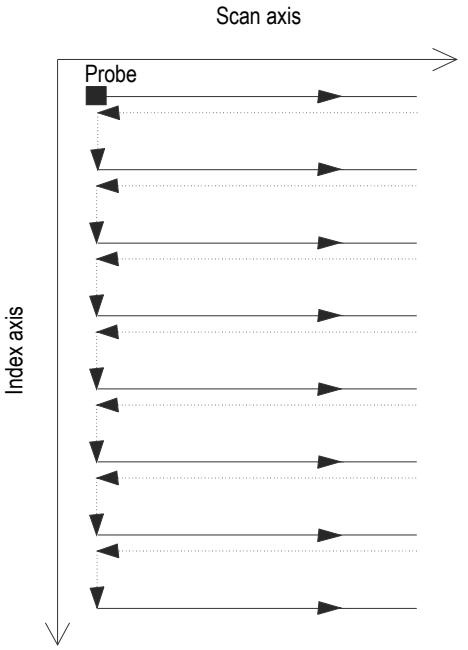

Figure 5-6 Unidirectional surface scan

The user must supply the limits of the inspection surface as well as the spacing between acquisitions (Figure 5-5 on page 159).

Operation mode

The Unidirectional scan operates as follows:

1. The scanner proceeds to the **Scan: Start** position set on the **Scan** tab.
2. The scanner proceeds to the **Index: Start** position set on the **Scan** tab.
3. The scanner then moves on the scan axis to the position set in the **Scan: Stop** box, while performing data acquisition.
4. Data acquisition is performed at every interval of the **Scan: Resolution** value set on the **Scan** tab.
5. The scanner returns to the **Scan: Start** position. No data acquisition is performed during this step.

6. The scanner moves on the index axis for the distance set in the **Index: Resolution** box.
7. The scanner then moves on the scan axis to the position set in the **Scan: Stop** box, while performing data acquisition.
8. Steps 4 to 6 are repeated until the scanner has reached the position set in the **Index: Stop** box. Then, the scan is finished when the scanner has reached the position set in the **Scan: Stop** box.

Description of the Scan tab

When you select the **Unidirectional** scan type, the **Scan** tab contains the set of options shown in Figure 5-7 on page 162.

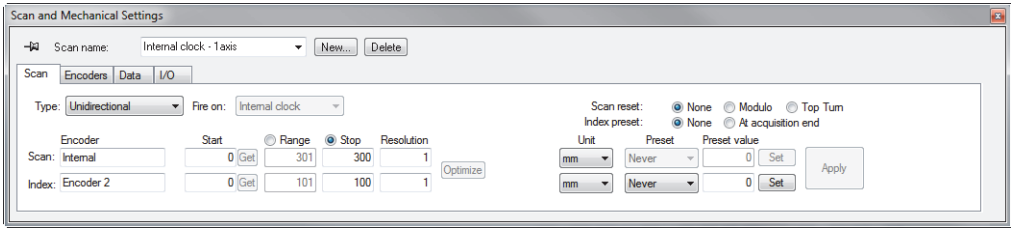

Figure 5-7 Scan tab for Unidirectional scan type

The **Scan** tab for a **Unidirectional** scan type contains the same options as for a **Bidirectional** scan type. For a description of these options, see “Bidirectional Scan” on page 157.

5.1.5 Helicoidal Scan

The Helicoidal scan type is similar to the Bidirectional scan. However, with this type of scan, the inspection mechanism performs a helicoidal movement around a cylinder.

A Helicoidal scan uses two axes: (1) the scan axis, which is the mechanical axis of the scanning lines (rotation), and (2) the index axis, which is the mechanical axis movement between the scanning lines (axial).

Operation mode

In a Helicoidal scan, the two mechanical axes are driven by two motors controlled by an external control unit or axes of a manually driven scanner.

The Helicoidal scan type operates as follows:

1. The scanner proceeds to the position set in the **Scan: Start** and **Index: Start** boxes of the **Scan** tab.
2. The scanner then moves on the scan axis and index axis to the position set in the **Scan: Stop** and **Index: Stop** boxes, while performing data acquisition. There is simultaneous motion on both axes.
3. Data acquisition is performed at every interval of the **Scan: Resolution** value set on the **Scan** tab.
4. In a Helicoidal scan, the scan axis is projected along the circumference of the cylinder. The **Scan: Start** and **Scan: Stop** values refer to the circumference origin point (0), in distance units or angular units.
5. A signal or a modulo can be used to reset the scan-axis encoder to the **Scan: Start** value after each complete rotation.
6. The scan is finished when the scanner has reached the position set in the **Index: Stop** box.

Description of the Scan tab

When you select the Helicoidal scan type, the **Scan** tab contains the set of options shown in Figure 5-8 on page 163.

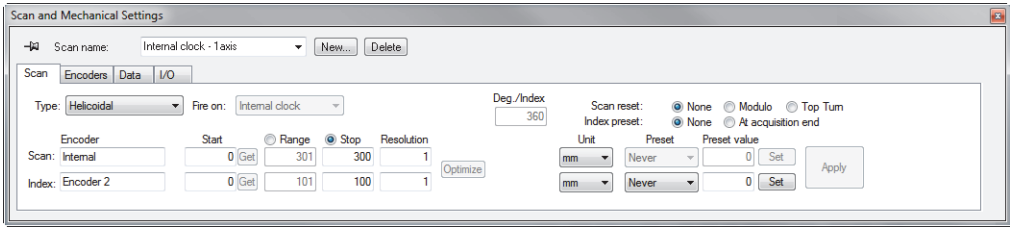

Figure 5-8 Scan tab for Helicoidal scan

The **Scan** tab for a Helicoidal scan type contains the same options as for a **Bidirectional** scan type. For a description of these options, see “Bidirectional Scan” on page 157. This tab also contains three additional option buttons and one additional parameter:

Deg/Index

This box defines the distance along the scan axis (in degrees) that is completed for each index increment. The **Index axis inspection speed** value is then deduced from this value, the **Scan axis inspection speed,** and the **Index resolution**.

The chosen **Deg/Index** value is usually slightly larger than 360 degrees, to obtain sufficient overlap between adjacent Helicoidal scan lines.

Scan reset

Click one of these option buttons to select one of the options used to reset the scan-axis encoder to position zero:

None: scan-axis encoder is never reset.

Modulo: scan-axis encoder is reset to position zero when a maximum value (modulo) corresponding to the **Scan: Stop** value is reached.

Top Turn: a synchronization signal is used to reset the scan-axis encoder to the **Scan: Start** value.

5.1.6 Angular Scan

The Angular scan type is a two-dimensional surface scan, where the scan and index axes do not correspond to the orientation of the mechanical axes, such as in the Bidirectional and Unidirectional scans. Instead, the scan and index lines form a certain angle with the orientation of the mechanical axes (Figure 5-9 on page 165). Two position encoders are used to determine the position during the acquisition.

A surface scan uses two axes: (1) the scan axis, which is the mechanical axis of the scanning lines, and (2) the index axis, which is the mechanical axis displacement between the scanning lines. At the end of each scan along the scan axis, an increment is added to the position along the index axis. With this scan type, the mechanical axes work together in such a way as to produce the desired scanning pattern. Data acquisition for angular scans is carried out in both the forward and backward directions along the scan axis.

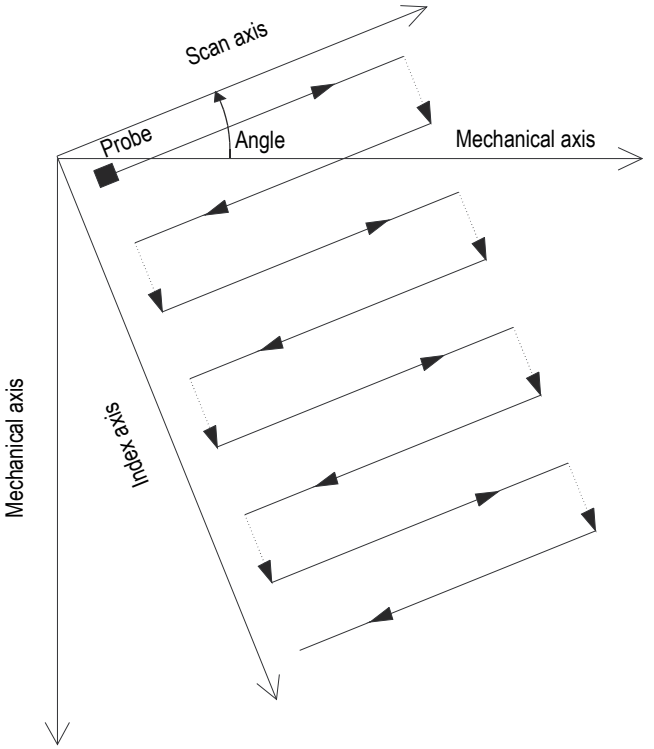

Figure 5-9 Angular surface scan

Operation mode

The Angular scan type operates as follows:

1. The scanner proceeds to the position set in the **Scan: Start** and **Index: Start** boxes of the **Scan** tab.
2. The scanner then moves on the scan axis, according to the specified angle, to the position set in the **Scan: Stop** box, while performing data acquisition.
3. Data acquisition is performed at every interval of the **Scan: Resolution** value set on the **Scan** tab.
4. The scanner moves on the index axis, according to the specified angle, for the distance set in the **Index: Resolution** box.

5. The scanner moves on the scan axis, according to the specified angle, to the **Scan: Start** position, while performing data acquisition.
6. The scanner moves on the index axis, according to the specified angle, for the distance set in the **Index: Resolution** box.
7. The scanner then moves on the scan axis, still according to the specified angle, to the position set in the **Scan: Stop** box, while performing data acquisition.
8. Steps 4 to 7 are repeated until the scanner has reached the position set in the **Index: Stop** box. Then, the scan is finished when the scanner has reached the position set in the **Scan: Stop** box (if the index axis has an odd number of steps), or when it has reached the **Scan: Start** position (if the index axis has an even number of steps).

Description of the Scan tab

When you select the **Angular** scan type, the **Scan** tab contains the set of options shown in Figure 5-10 on page 166.

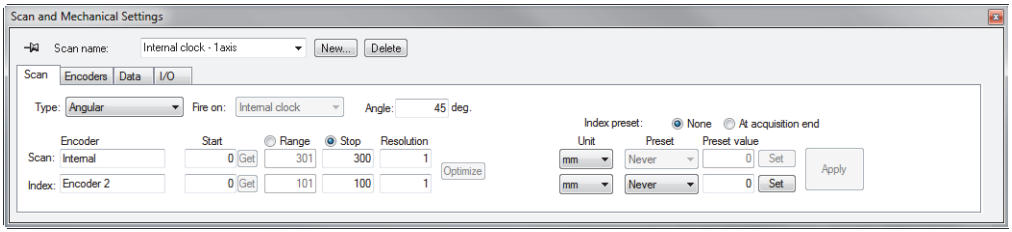

Figure 5-10 Scan tab for Angular scan type

The **Scan** tab for an **Angular** scan type contains the same options as for a **Bidirectional** scan type. For a description of these options, see “Bidirectional Scan” on page 157. This tab also contains an additional parameter, which is required for this scan type:

Angle

This box is used to set the angle that the scan line forms with the orientation of the mechanical axis.

5.1.7 Custom Scan

Selecting the **Custom** scan type automatically opens the **Load Custom Program File** dialog box (Figure 5-11 on page 167). This dialog box is used to select and load a special type of scan predefined in a .gal file.

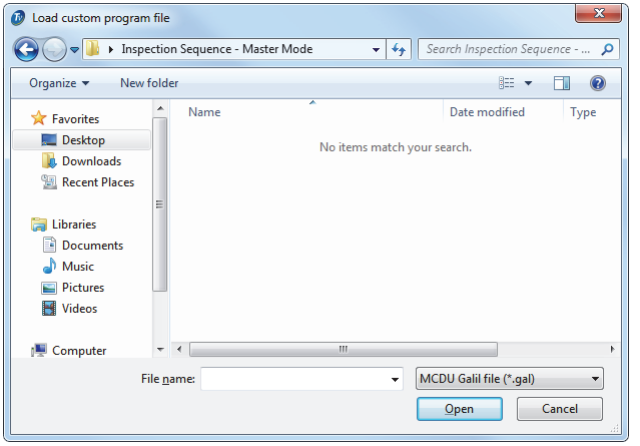

Figure 5-11 Load custom program file dialog box

5.2 Working with Encoders

You can use one or more encoders in your setup to measure the position of the probe on the scanned area.

FocusPC supports different types of encoders (see “Encoder Types” on page 167).

You need to calibrate each encoder (see “Calibrating an Encoder” on page 170).

5.2.1 Encoder Types

FocusPC supports various types of encoders. You can select the encoder type on the **Encoders** tab of the **Scan and Mechanical Settings** dialog box (Figure 5-12 on page 168).

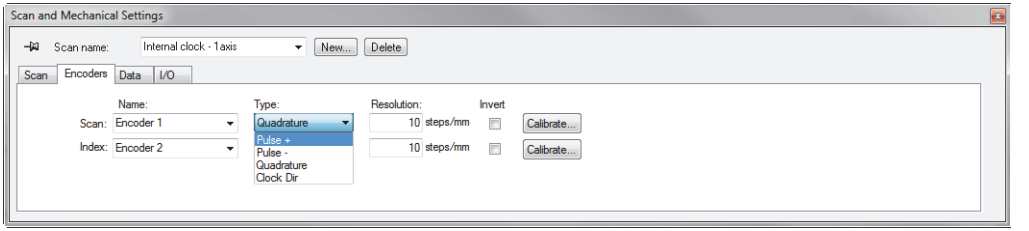

Figure 5-12 Selecting the encoder type on the Encoders tab

Each encoder input on your acquisition unit has two channels, A and B, enabling a dual-channel encoder for a quadrature reading of the resolution.

The available encoder types are as follows:

Clock Dir

Select this option when you use a stepper controller and its documentation specifies that the position output signal is a clock/direction type (5 V pulse for the position/speed and 5 V signal for the direction).

Quadrature

Select this option when the attached encoder (5V TTL output) is a dual-channel output encoder. The channels are generally named A and B. When the encoder is rotating clockwise (from left to right in Figure 5-13 on page 169), channel B follows channel A with a 90-degree delay. When the encoder is rotating counterclockwise, channel A follows channel B with a 90-degree delay. In this way you can determine if the rotation is clockwise or counterclockwise. The decoder counts one step each time it detects a rising or a falling edge on channel A or channel B. This means that if the real encoder resolution is 1000 steps/revolution, the final resolution with the quadrature reading is 4000 steps/revolution.

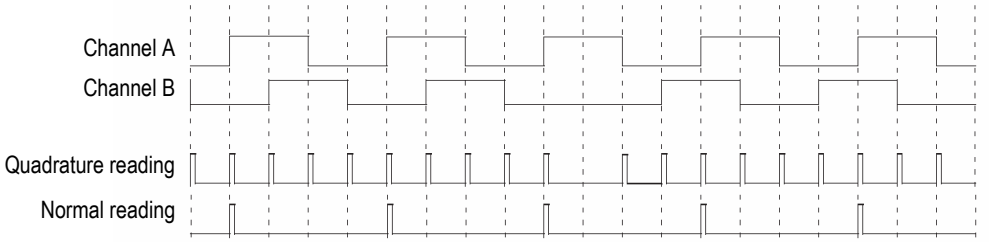

Figure 5-13 Quadrature and normal reading of the resolution

Up

The decoder only reads channel A and increments the counter even if the encoder is turning counterclockwise. The final resolution is the real encoder resolution.

Down

The decoder only reads channel A and decrements the counter even if the encoder is turning clockwise. The final resolution is the real encoder resolution.

Clock/Dir Up

The decoder only reads channel A and increments the counter. When the signal of channel B (direction) is high, the acquisition stops to prevent overwriting the data while you move the probe back and the counter is decremented.

Clock/Dir Down

The decoder only reads channel A and decrements the counter. When the signal of channel B (Dir) is high, the acquisition stops to prevent overwriting the data while you move the probe back and the counter is incremented.

Quad Up

The decoder reads channel A and channel B in quadrature mode (4 times the encoder resolution) and increments the counter when the encoder rotates clockwise. When the encoder rotates counterclockwise, the acquisition stops to prevent overwriting the data and the counter decrements.

Quad Down

The decoder reads channel A and channel B in quadrature mode (4 times the encoder resolution) and decrements the counter when the encoder rotates counterclockwise. When the encoder rotates clockwise, the acquisition stops to prevent overwriting the data and the counter increments.

5.2.2 Calibrating an Encoder

You need to calibrate an encoder to validate, fine-tune, or determine its resolution. The resolution of an encoder is the number of steps corresponding to a traveled distance of 1 mm or 1 in., or 1 degree.

Perform the following procedure for each encoder that you are using.

To calibrate an encoder

1. On the component toolbar, click the Scan and Mechanical Settings button ( ).
2. In the **Scan and Mechanical Settings** dialog box, click the **Scan** tab, and then perform the following tasks:
   a) In the **Type** box, select the appropriate scan type for your application. Do not select **Free running** as this type does not support encoders.
   b) In the **Unit** box, select the appropriate linear or angular units.
3. On the **Encoders** tab (Figure 5-14 on page 170), proceed as follows:
   a) In the **Type** box, select the type of your encoder (see "Encoder Types" on page 167).
   b) Click **Calibrate**.

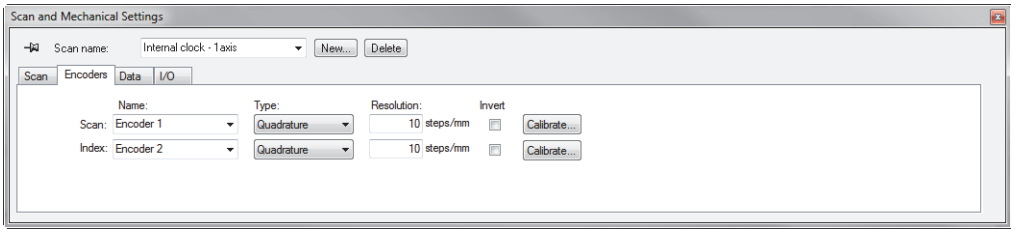

Figure 5-14 Encoders tab of the Scan and Mechanical Settings dialog box for an Encoded - 2 axis scan type

4. While in the **Calibration of Encoder** dialog box (see the example shown in Figure 5-15 on page 171), proceed as follows:
   a) Optionally, move the required encoder (or the mechanical parts attached to the encoder) to a known position on the axis, and then click **Set**.

   This operation sets the current position to the value of the **Preset value** box that has been specified on the **Scan** tab.

b) Click **Set Begin**.

c) Move the encoder over a defined distance on the axis in the direction that is considered positive. Use the **Movement** buttons to move the scanner.

d) Click **Set End**.

e) In the **Set Distance** box, enter the traveled distance, and then click **Set Distance**.

The resulting encoder resolution appears in the **Calculated resolution** box.

f) When needed, click **Clear** to reset the parameter values, and then return to step 4.*a*.

g) Click **OK** to apply the calculated encoder resolution.

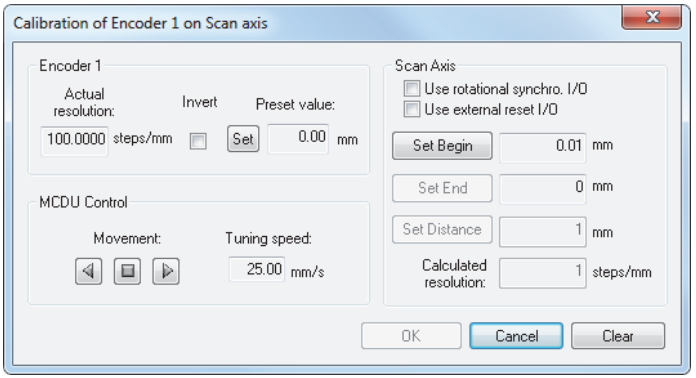

Figure 5-15 Calibration of Encoder dialog box for encoder 1 on the scan axis

5.3 Defining the Automatic Savings Options

On the **Options** tab of the **Scan and Mechanical Settings** dialog box, you can use the **File Naming Options** section to configure the way the data files will be saved at the end of the inspection (Figure 5-16 on page 172).

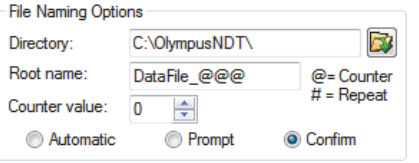

Figure 5-16 File Naming Options dialog box

To configure the automatic saving options

1. Set **Directory** to the folder where the files are to be saved.
2. Set **Root Name** to the name of the data files to be saved.
   - The **@** character inserts a counter that will automatically increase the file name by one. For example, entering **test@** will generate test0.fpd, test1.fpd, test2.fpd, and so on.
   - The # character adds the desired number of digits for repeats. For example, typing **test@##** will generate test000.fpd, test100.fpd, test200.fpd, and so on.
   - If a file exists (for example, test000.fpd) then the new file will be saved under the following name: test001.fpd (first repeat of the test000.fpd file name).
3. Set **Counter value** to configure the start value of the counter that is inserted in the file name with the @ character.
4. Select the **Automatic**, **Prompt**, or **Confirm** saving mode.
   - The **Automatic** mode will save the data files without asking for a confirmation.
   - The **Prompt** mode will deactivate the automatic file naming and ask you to enter the data file name at the end of every acquisition.
   - The **Confirm** mode will ask you to confirm the file name defined in the Root name before saving the data file.

6. Basic Analysis Using FocusPC

After the data acquisition is complete, FocusPC can be used to analyze the resulting data files. This section describes the basic analysis in FocusPC, demonstrating how you can manage data files to create simple and convenient reports making the inspection results easy to understand.

6.1 Opening Data Files in FocusPC

This section describes how to open FocusPC data files and merge data files in order to combine multiple inspection data to a single file that can then be analyzed and described in a simple report.

The **Open** dialog box (Figure 6-1 on page 174) is used to select and load an ultrasonic data file as well as the other data types that can be linked to this file.

To open a FocusPC data file

1. In the main menu, click **File > Open**.
2. Make sure that **Data Files** is selected in the upper-left section of the **Open** dialog box.
3. Select the appropriate **File Content** and **Processing** options (see the descriptions below for more information on these options).
4. Click **Open**.

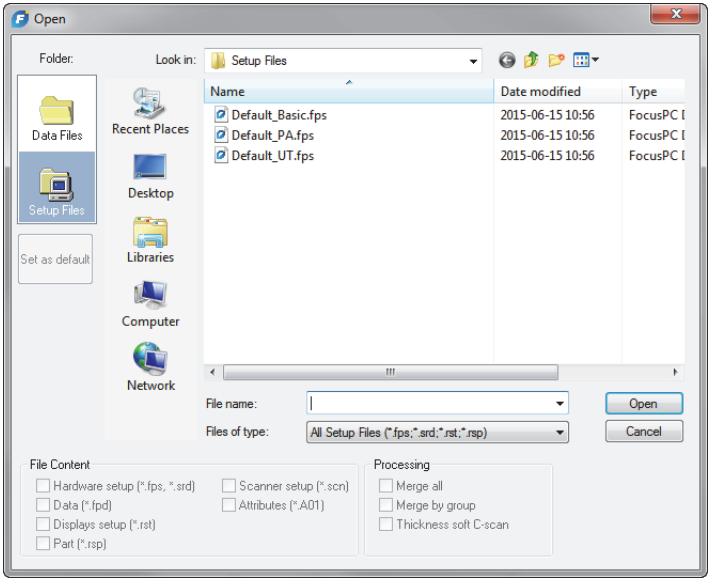

Figure 6-1 Open dialog box

The **File Content** and **Processing** areas of the **Open** dialog box contain the following options:

File Content

You can use the check boxes under **File Content** to select the appropriate associated files (for a description of the file types, see “File Formats” on page 94).

For example, an .fpd data file can be saved with an .A01 data file resulting from analysis processing. You can then either open the original data alone (.fpd file), or open the original data along with the data modified in analysis (.fpd and .A01 files). The principle of associated files allows the original data to remain intact after the data file is saved.

Only the file types that are associated with the .fpd file when saving the data can be selected. The dimmed file types are not available.

Processing

You can use the check boxes under **Processing** to select optional calculations to be performed on the file to be opened. After opening the file, FocusPC calculates the selected processing options and adds the associated data groups to the file.

— The **Merge all** check box performs the same calculations as the corresponding toolbar command ( ).

— The **Merge by group** check box performs the same calculations as the corresponding toolbar command ( ).

6.2 Working with the Indication Table and Report Component

The indication table is a key feature of FocusPC (Figure 6-2 on page 175). Use the indication table to gather flaw indication information and to create an HTML report. The following are basic steps for using the indication table:

- Use the cursors and the Zone tool to highlight an indication.
- Open the indication table and add an indication.
- Add comments and extra readings to the table.
- Customize the report.
- Preview and produce the HTML report.

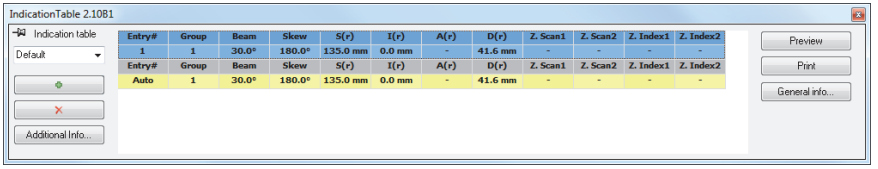

Figure 6-2 Indication table

NOTE

FocusPC automatically saves the indication table in the display setup file (.RST) and automatically saves the numerical reading indication information contained in the indication table in an attribute file (.R01).

6.2.1 Adding an Indication to the Indication Table

Use the Zone tool and the indication table to quickly select the area corresponding to an indication and create a record for the indication.

TIP

You can customize the sizing settings in the **Preferences** dialog box on the **General Settings** tab under **Flaw-Sizing Settings**.

To add an indication to the indication table

1. Select a layout with views that best illustrate the indications in the part (see the example shown in Figure 6-3 on page 176).

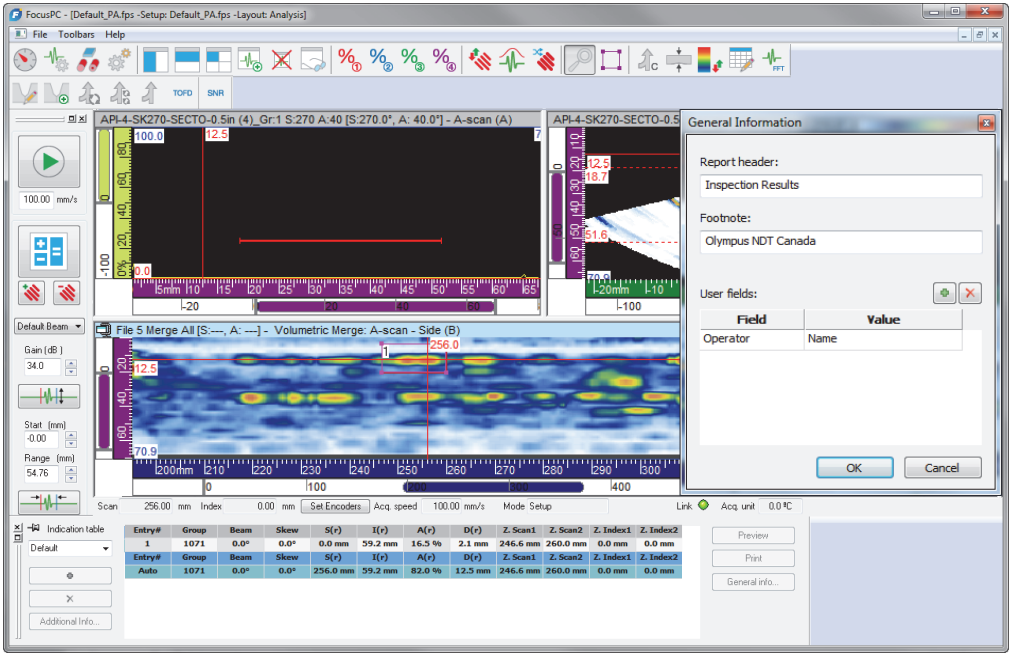

Figure 6-3 Example of the indication table, the cursors, and the Zone tool used to document an indication

2. On the component toolbar, click the Indication Table button ( ) to display the **Indication Table** dialog box.

   The first line of the table indicates the current value of the selected readings.
3. Position the Reference and Measurement cursors to mark the indication.
4. Using the Zone tool, draw a zone around a flaw indication.
5. In the **Indication Table** dialog box, select a predefined reading category (Figure 6-4 on page 177) to determine the readings that appear in the table.

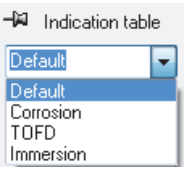

Figure 6-4 Selecting a predefined reading category in the indication table

---

TIP

You can select a different reading category for each indication table entry. The indication image is a snap shot of the data display views taken when you click [ ]. When you want to put the emphasis on the defects characteristics, configure the views accordingly before clicking [ ].

---

6. In the **Indication Table** dialog box, click [ ].

   The selected flaw indication is added to the **Indication Table** list and a red marking rectangle labeled with the indication number appears on the view.
7. As needed, repeat steps 3 to 6, to mark other indications.
8. You can add a comment to an indication:
   a) In the **Indication Table** dialog box, select the indication to which you want to add a comment by clicking the corresponding line in the table.
   b) Click **Additional Info**.
   c) In the **Custom Readings** dialog box that appears (Figure 6-5 on page 178), type your comment for that indication in the **Comment** box.

The comment then appears in the **Comments** section of the report for the selected indication.

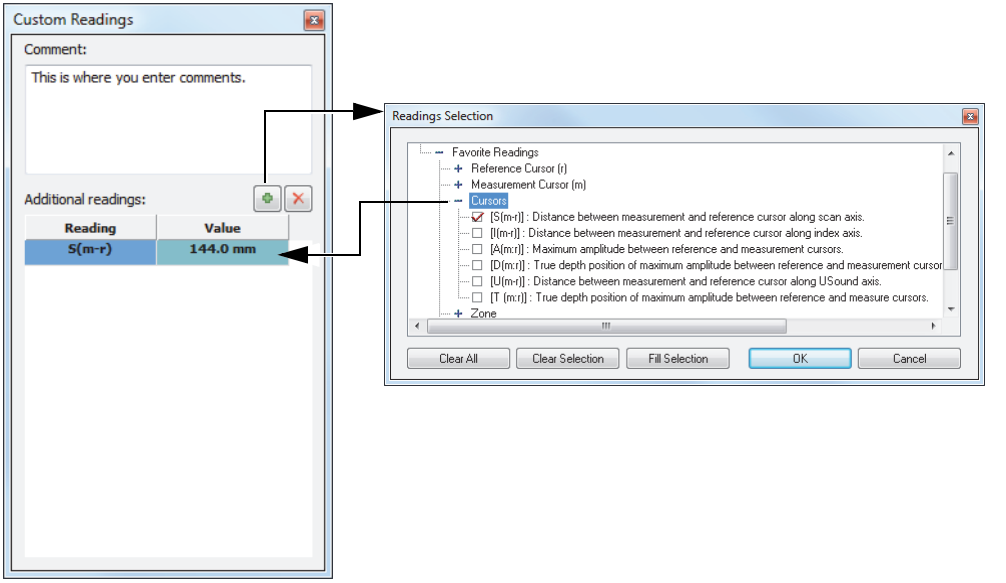

Figure 6-5 Adding a comment and an additional reading to an indication

9. You can also include additional readings in the indication table (Figure 6-5 on page 178):
   a) In the **Indication Table** dialog box, select the line for the **Entry# = Auto** indication.
   b) In the **Custom Readings** dialog box, click .
   c) In the **Readings Selection** dialog box that appears, select the check box of one or more readings that you want to add to the selected indication, and then click **OK**.

   The selected readings appear in the **Custom Readings** dialog box, under **Additional readings**.

NOTE

Additional readings appear only for new indications, not for those already entered in the indication table.

6.2.2 Producing an Ultrasonic Inspection Report

When you have completed the indication analysis using the indication table, you can produce an HTML ultrasonic inspection report from the **Indication Table** dialog box. This report includes the following elements for each defined group of the configuration:

- Setup information
- Inspected part information
- Scanned area information
- Content of the indication table
- Views for each entry of the indication table
- Customized information

To produce an ultrasonic inspection report

1. Gather indication information in the indication table (see "Adding an Indication to the Indication Table" on page 176).
2. In the **Indication Table** dialog box, click **General info** to open the **General Information** dialog box, and customize the HTML report (Figure 6-6 on page 180):
   a) In the **Report Header** box, type your report header information.
   The text appears at the beginning of the report (Figure 6-7 on page 180).
   b) In the **Footnote** box, type your report footnote information.
   The text appears in the **Notes** section at the end of the report (Figure 6-8 on page 181).
   c) Click .
   d) Type the custom information label in the **Field** box and the corresponding value in the **Value** box.

The added user fields appear in the second section from the top of the report (Figure 6-7 on page 180).

e) Click **OK**.

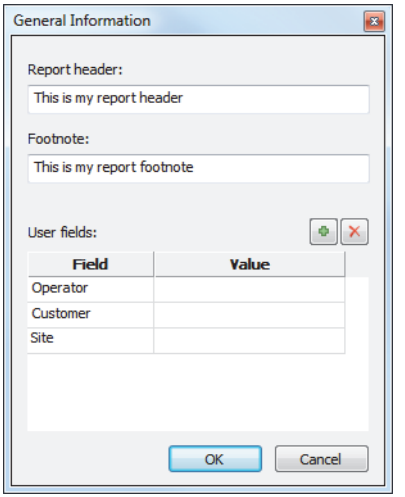

Figure 6-6 Example of the General Information dialog box

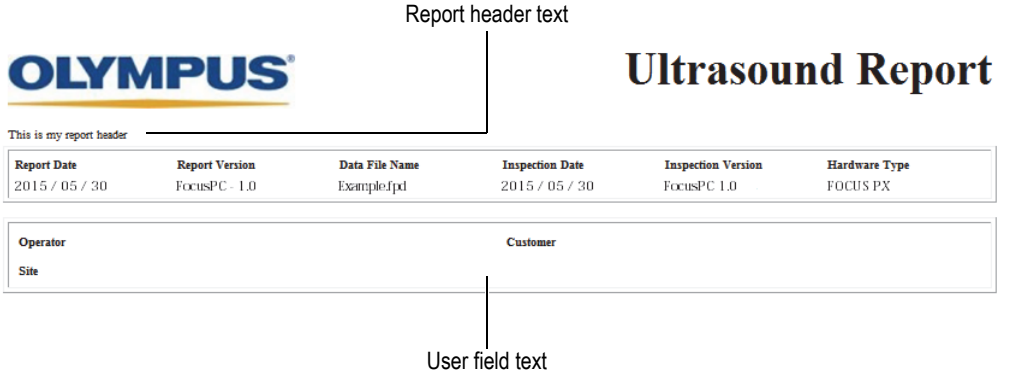

Figure 6-7 Example of a report header and user fields

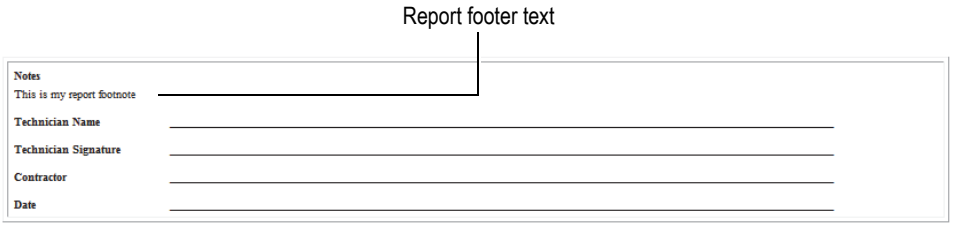

Figure 6-8 Example of a report footer

3. Back in the **Indication Table** dialog box, click **Preview**.
   The HTML report appears in your Internet browser.
4. Review the report.
5. In the **Indication Table** dialog box, click **Print**.
6. In the **Print** dialog box, select the printer, and then click **Print** to print the report.

6.2.3 Changing the Logo in the Inspection Report

The Evident logo appears by default at the top of the inspection report. You can change the logo.

TIP

Ensure that you change the logo before creating the report. Otherwise, the old image will appear in the report. You then need to delete the report file (.r01) and add the indications again.

To change the logo appearing at the top of the inspection report

1. Create a small image of the logo that you want to see at the top of the inspection report.

TIP

Use a logo image that is about the same size as the Evident logo image (200 pixels wide by 38 pixels high).

2. In the [Installation Folder]\FocusPC*nnn* folder, proceed as follows:
   a) If you do not want to lose the Evident logo file, rename the logo.jpg file to Evident_logo.jpg.
   b) Save the image of your logo in the JPEG format using the logo.jpg file name.

   Your logo appears at the top of the next inspection report that you generate.

NOTE

For more information on the advanced features of this software and detailed menu descriptions, refer to the *FocusPC Advanced User's Manual*.

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