

Getting Started with

TSC PACE



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Overview

Introducing TSC PACE

This document describes the operation and use of the PACE™ Instrument and its accompanying software.

PACE™ is an advanced portable NDE tool designed to inspect metallic materials for surface breaking cracks. It is based on an inspection technique called Alternating Current Field Measurement (ACFM®) which has a proven track record in the oil and gas industry.

ACFM® is an electromagnetic technique that uses a probe to induce a small uniform AC current to flow in the surface of the material under test. Defects in the material will disturb this current flow and this disturbance will be reflected in the magnetic field above the surface of the material. Sensors in the probe measure the disturbances and produce characteristic signals when flaws are present. Analysis of the magnitude of the disturbance gives a prediction of the depth of the defect.

PACE™ Instrument

PACE™ is a portable, lightweight instrument that embodies robust, user-centric, ergonomic features; with a high-contrast toughened screen, long battery life (8+ hours) and supported by a new generation of software. It supports left and right handed use and has four secure harness attachment points.

Figure 1 PACE Front Panel Overview



- | | |
|---|---|
| <p>1. A,C & T Select anticlockwise, clockwise and transverse scan direction. During a scan A, C & T produce linear, clock and general markers respectively.</p> <p>2. Green button Start and stop the data collection.</p> <p>3. Yellow button Pause and unpause the data collection during a scan.</p> <p>4. F1 – F4 Page specific function buttons.</p> | <p>5. Question mark Used to open context specific help files.</p> <p>6. Yellow arrows Used for selection during navigation and for toggling through view setting when reviewing data.</p> <p>7. Green tick button Used for selection during menu navigation and for toggling through view setting when reviewing data.</p> <p>8. Back button Used to go back one step during menu navigation.</p> |
|---|---|

SENSU™ Probes

The PACE™ instrument works with the SENSU™ branded probes, previous ACFM probes are not compatible with this system.

The probes included in the standard system are of two types: a straight 5 kHz pencil probe (Type 618) and a right-angled pencil 5 kHz probe (Type 619). Other probe types are available on request.

Home Screen

The PACE™ instrument can be started by pressing the power button located on the top right of the system. The boot up sequence will take the user to the PACE™ Home screen.

Figure 2 PACE™ Home Screen



The top right hand corner displays hardware information, namely, the PACE™ instrument serial number, SENSU™ probe serial number and the next recalibration date. The bottom right hand side displays the next scan parameters and can be altered in the Next Scan Param window. The left hand side displays a legend for the left/right hand keypads.

The probe files for the SENSU™ probes are pre-loaded onto the probe and auto-install onto the system when the probe is connected to the system.

Figure 3 Probe Disconnected Message

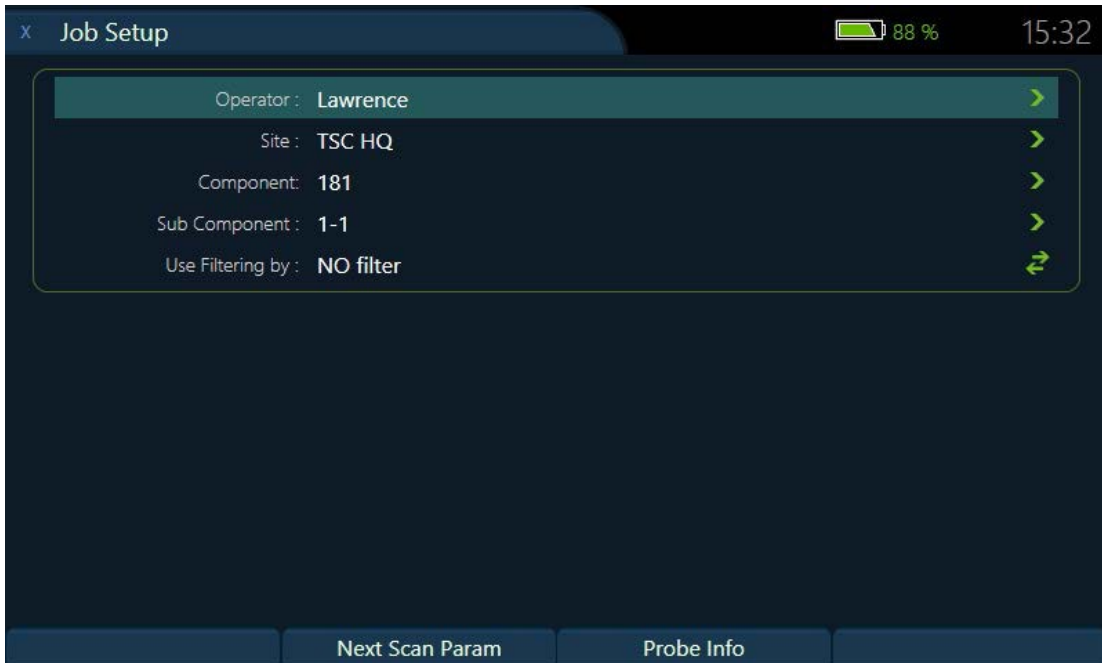


When the probe is disconnected a “No Probe” message will be displayed on the top of the screen.

Job Setup

The Job Setup window is where the operator can set up all the information relevant to the inspection before the job begins.

Figure 4 Job Setup Window



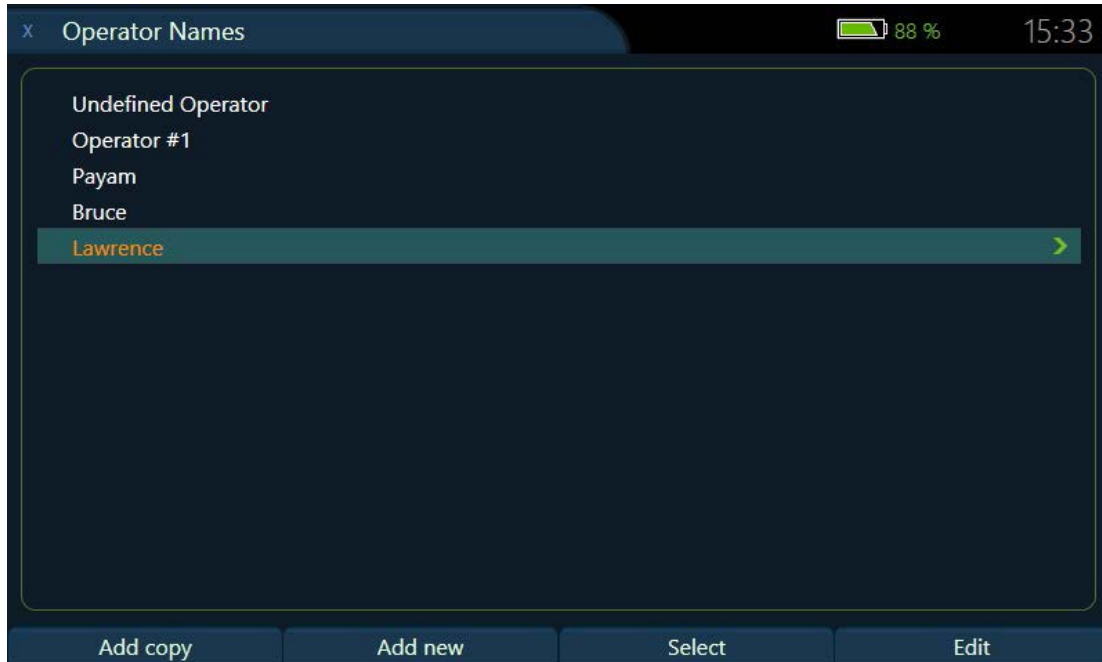
In this window the operator can add/edit the Operator names, Site, Component and Sub-Component used for the job(s). The operator can also filter the displayed data in the Data Screen to display data selected by Operator, Site, Component or Sub-component.

The Probe Info tab displays the technical attributes of the attached probe (Phase, frequency, Gain, etc).

Entering Job Information

Selecting any of the job parameters will open a window to add, edit or delete the selected list.

Figure 5 Entering Job Information

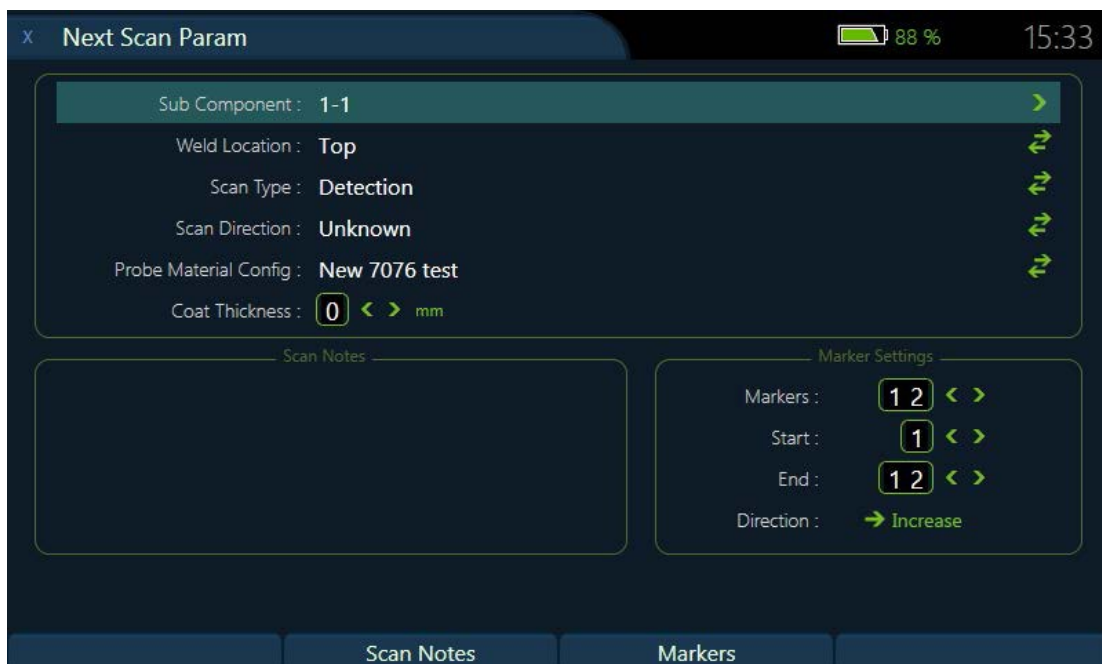


- Add new allows the operator to add new entries.
- Add copy allows the operator to edit a copy of one the entries as a new entry.
- Select allows the operator to select an entry and goes back to the previous screen.
- Edit opens a new window that allows the operator to edit the entry, move it up and down in the list or delete it.

Next Scan Parameters

The Next Scan Parameters window is where the operator toggles through the different scan properties of the next scan to be performed.

Figure 6 Next Scan Parameters



The operator can cycle through the entered sub-component list as well as the pre-set weld location, scan type and scan direction lists. If the attached probe has more than one material config; these can also be chosen from this menu.

If the inspection is being conducted through insulating coating, the thickness of the coating can be specified here.

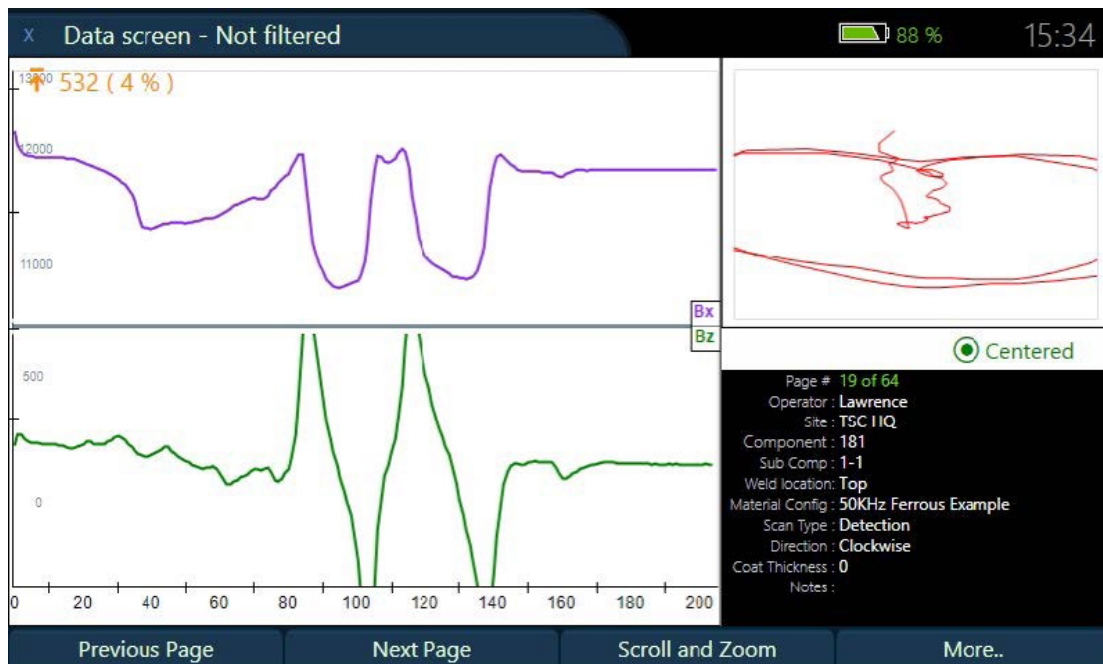
The clock marks settings located in the bottom right of the screen can be configured to give the desired start and end marker as well as if the marks are incrementing or decrementing.

Pressing the **Scan Notes** button opens the text editor and allows the operator to pre-enter the notes for the next scan. It is also possible to edit/enter notes after a scan in the page properties tab.

Data Screen

The data screen is the main screen for viewing and analysing the scan data.

Figure 7 Data Screen



The top window shows the Bx trace, the bottom window shows the Bz trace and the Top-right window shows the butterfly plot.

The bottom-right window displays page specific scan information.

The scan can be moved around using the up/down/left/right on the keypad

Scanning Modes

The data can be viewed and scanned in three different modes, namely config, centered and fit.

The active scanning mode can be viewed in the info box under the butterfly plot



- Config mode is the default modes and takes its scale numbers directly from the probe file.
- Centered mode is a dynamic scanning mode that tracks the Bx and Bz lines and auto-centres them if they drift off-screen.
- Fit mode is a dynamic scanning mode that auto-fits the entire scan to the page

Note that the fit mode will change the scaling away from the default. When this occurs a "Scalings Lost!" message will appear on the Bx/Bz trace.

Pressing the **arrow keys** to move the traces up and down also holds the scanning mode in that current position. Any new scans or scrolling of scan pages will preserve this held mode until the scan mode is toggled.

Scanning Data

To begin a live scan the operator needs to press **A/C** or **T** to select the scan direction and then the **Start scan** button. Alternatively, if the scan parameters need to change, the operator can press the **Pause** button to quick access the Next Scan Parameters window, use **T** to scroll through the selection and **A/C** to cycle through the options before pressing **Start scan** button to begin the scan.

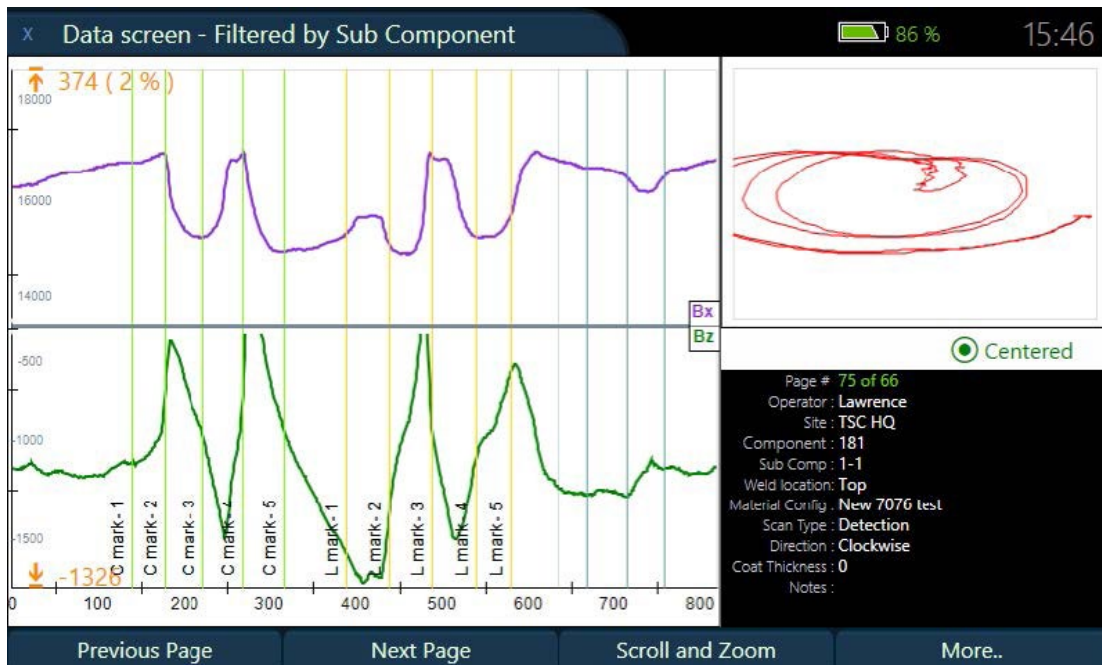
Figure 8 Next Scan Parameters Quick Access



Markers

During the scan the operator can add marks to the data by pressing **A**, **C** or **T** for linear marks, clock marks and general marks respectively.

Figure 9 Markers



Linear marks start from 1 and continuously increase. Clock marks can start from any number (defined in Next Scan Parameters) and they loop around a maximum number, they can also be set to increment or decrement.

The clock marks can be configured from the Next Scan Parameters window.

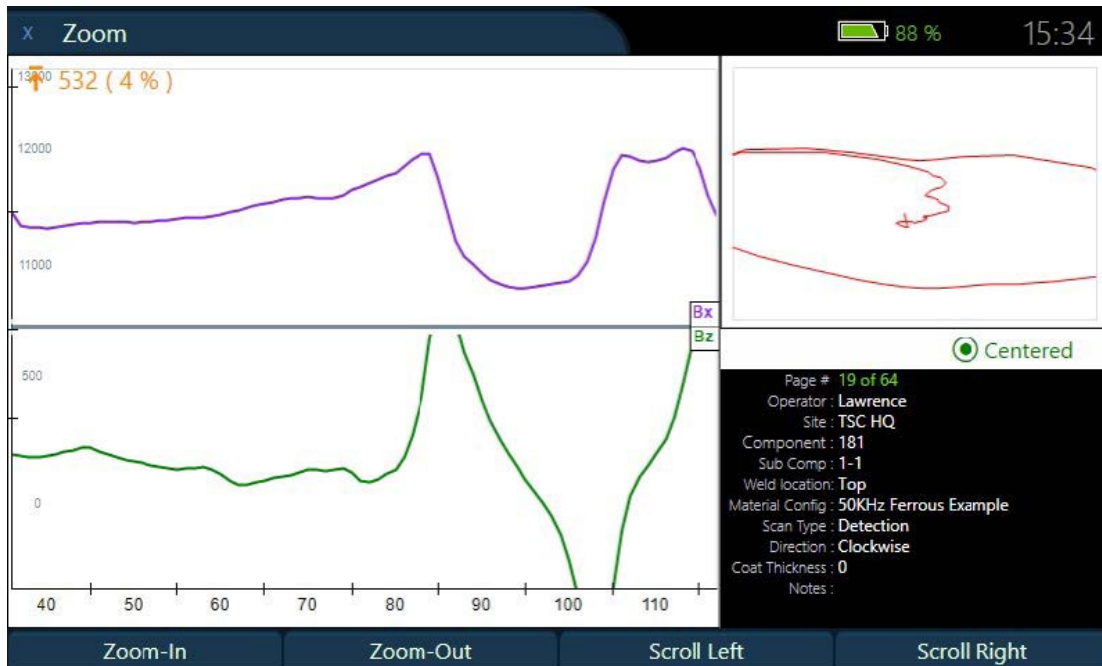
Data Analysis

To aid in the interpretation and analysis of the ACFM data, the PACE™ instrument has a number of useful features, namely, Scroll and Zoom, Replay, Camera, Defect Sizing and Scan Report.

Scroll and Zoom

The Scroll and Zoom screen is where the operator can zoom and move the selected screen.

Figure 10 The Zoom Function

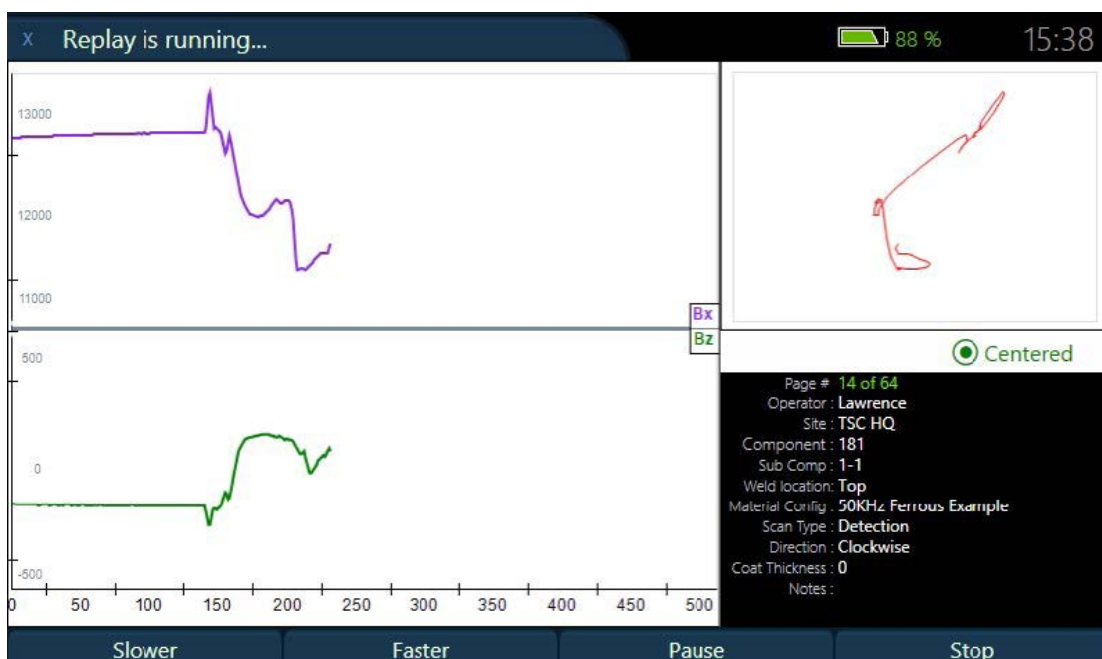


The operator can zoom in and out using F1 and F2 function buttons and scroll through the data left and right using F3 and F4 function buttons.

Replay

The Replay screen is where the operator can replay the selected scan.

Figure 11 The Replay Screen



The operator can toggle the replay speed using **F1** and **F2** function buttons, Pause the replay using **F3** and stop the replay with **F4**.

The replay will continuously loop until stopped by the operator.

Camera

The camera function allows the operator to take photos of the inspection piece to be included in the report or imported separately.

Figure 12 Camera



Pictures can be taken using the **F4** button “**Take Picture**” or the **T** button. The number of shots taken is displayed on the right hand side of the screen. The shots taken are always associated with the current scan page in the data screen. After data backup the raw pictures can be found in the scan page folder.

Defect Sizing

When a defect is found, the length and depth of it can be calculated from the Defect Sizing screen. In the screen, **F3** button adds a defect zone active window to begin the procedure.

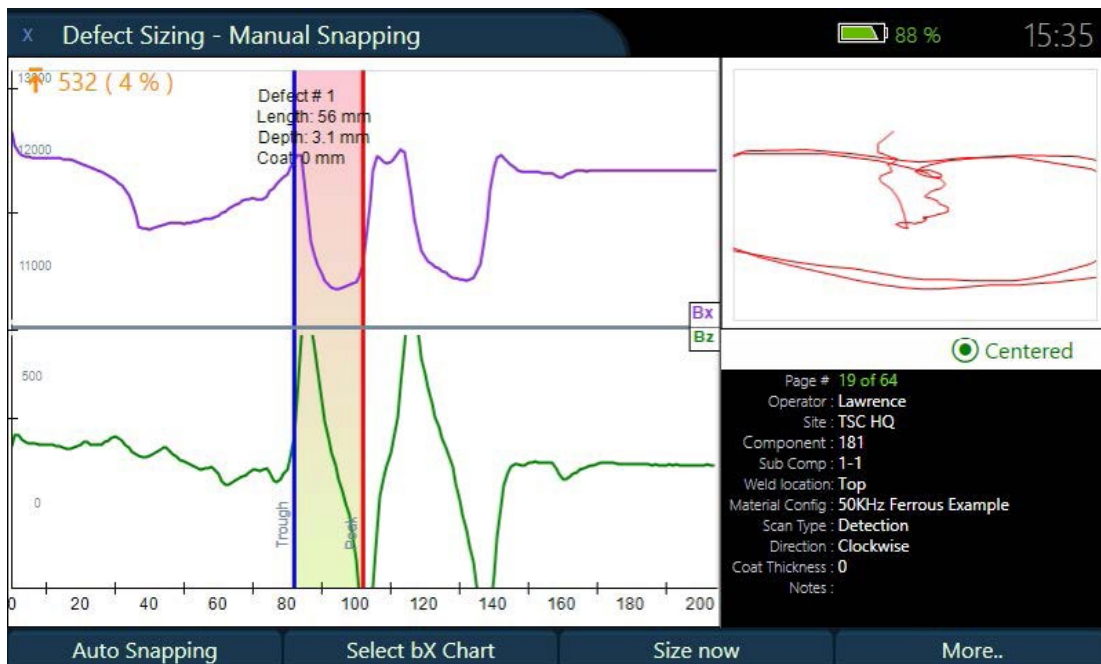
Figure 13 Defect Sizing – Auto Snapping



There are two modes for sizing defects, auto snapping and manual snapping. In auto snapping mode, the Bx and Bz sizing lines automatically snap to features as you move the active window.

The active window is moved using the left/right arrows and the width of the window is adjusted using the up and down arrow.

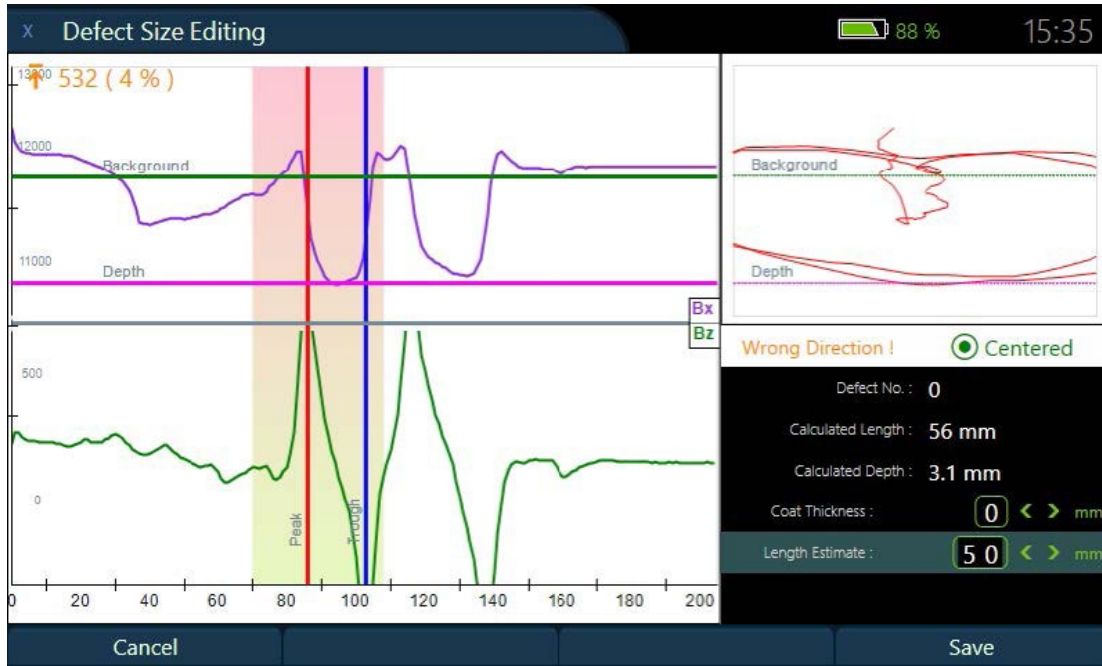
Figure 14 Defect Sizing - Manual Snapping



In manual snapping mode, the Bx and Bz sizing lines can be adjusted manually by the operator. **F2** button can be used to toggle between the Bx and Bz chart, the left/right arrows are used to move both lines and the up/down arrow moves just right line in the Bz and the Depth line in Bx.

The typical procedure (using Figure 14 as an example) would be to use left/right arrows to line up the Trough and Background lines then up/down arrows to line up the Peak and Depth lines.

Figure 15 Defect Sizing - Calculating the length and depth



Once the operator has set the sizing lines, the **F3** button will open the Size now screen.

In Size now, the operator can input the length estimate for the defect and the software will return a calculated length and depth.

Figure 16 Defect Sizing - Region with defect information



F4 button will save the calculated length and depth. This is displayed on the scan page as a defect region with text displaying the defect #, length, depth and coating thickness.

More defects on the page can be sized by adding a new defect zone active window using the **F3** button "Add Defect Zone"

Defect zone(s) can be toggled through and edited using the **F2** button "Select Defect"

Defect zone(s) can be deleted by selecting and navigating to **F4** button "More" and selecting "Delete Defect Zone"

Field Report

The field report function allows the operator to collect all the scan information (defect info, notes, probe info, photos) and creates a formatted report in pdf and word format. Navigate to **F4** button "More" and select "Create/Edit Scan Report".

Figure 17 Field Report Generation

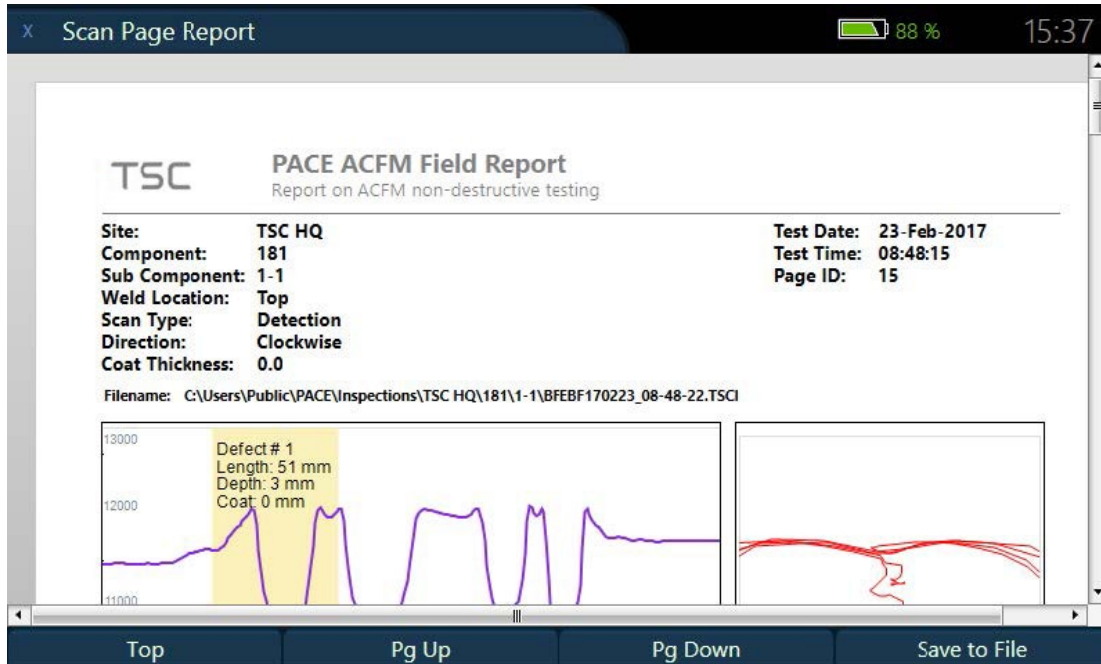
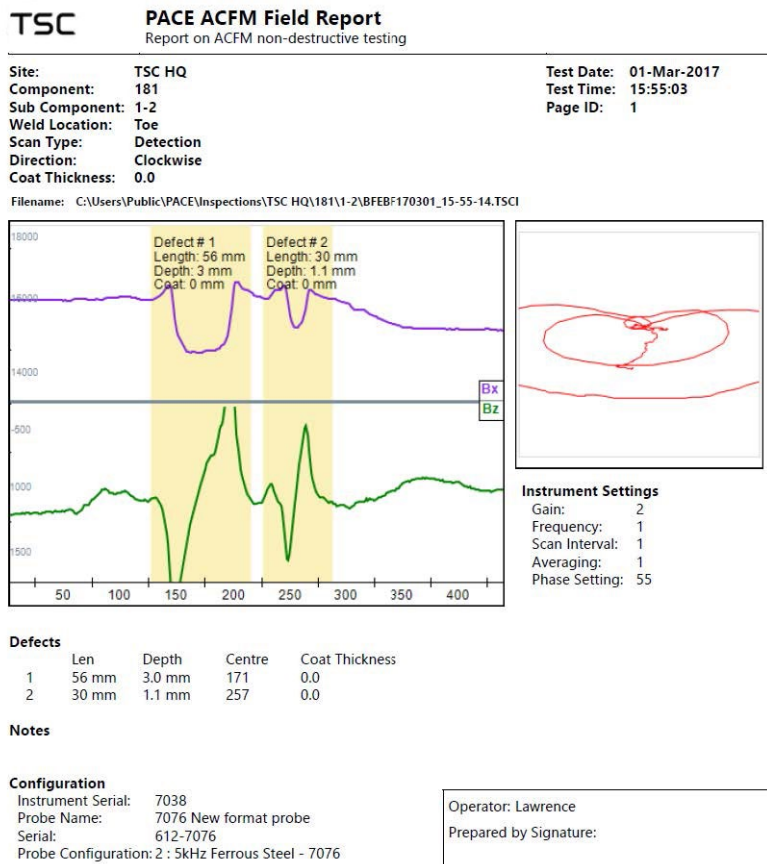


Figure 18 Example Field Report

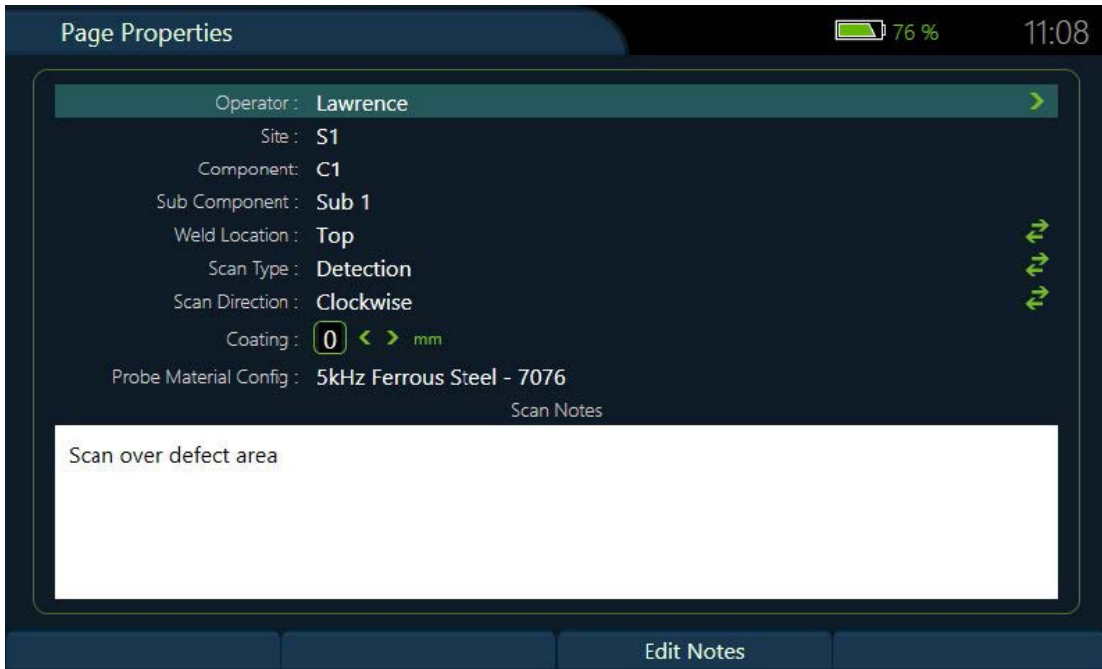


Pressing the **F4** button "Save to File" will save the report to the hard drive. If the page information is subsequently edited, recreating and then saving the report will update the information. Additional images of the scan (zoomed in, different scale etc.) can be added to the report using the "Add Chart Image to Report" function.

Page Properties

While reviewing the scan data it is possible to view the full scan parameters from the Page Properties window. Pressing the **F4** button “More” then “Page Properties” will open the window.

Figure 19 Page Properties



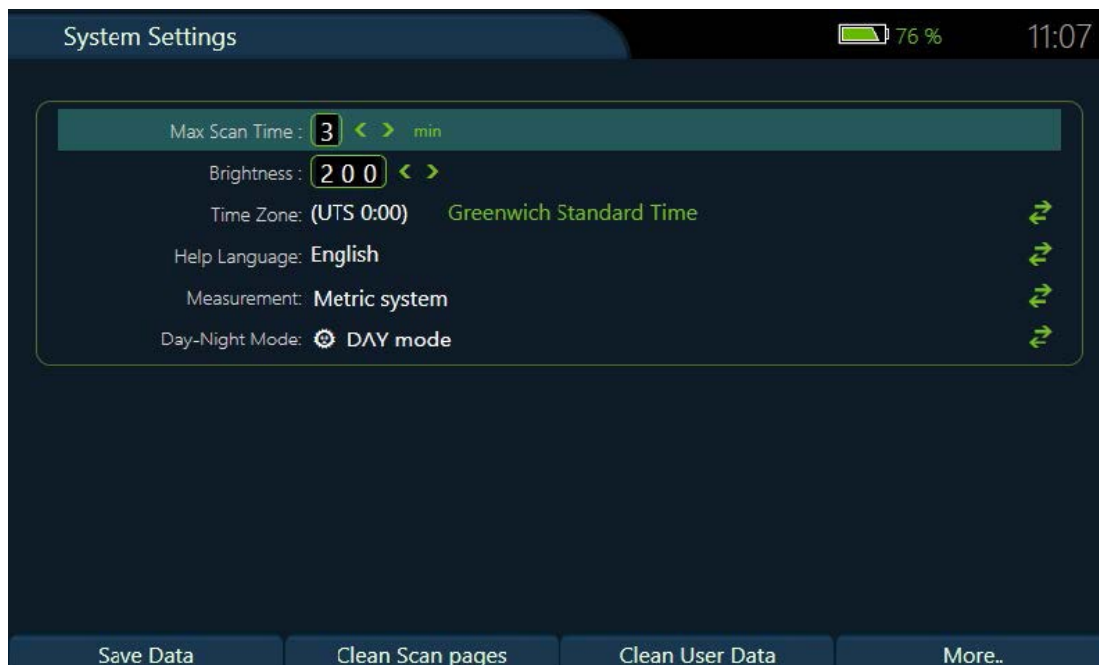
From the parameter list, operator name, scan direction, weld location, notes can be edited if required from this window.

System Settings

System Settings

From the system settings menu it is possible to toggle the max scan time, brightness settings, timezone, day-night mode, display units and help language.

Figure 20 System Settings



- The max scan time sets how long an individual scan can go before the software auto-stops it, this ranges from 3 – 10 minutes.
- The brightness setting dims and brightens the screen to the operators preference, this can also be done in the home screen using the up/down arrows.
- The timezone setting changes the time to reflect the present geographic region.

Note: An automatic restart of the instrument is initiated whenever the timezone is changed

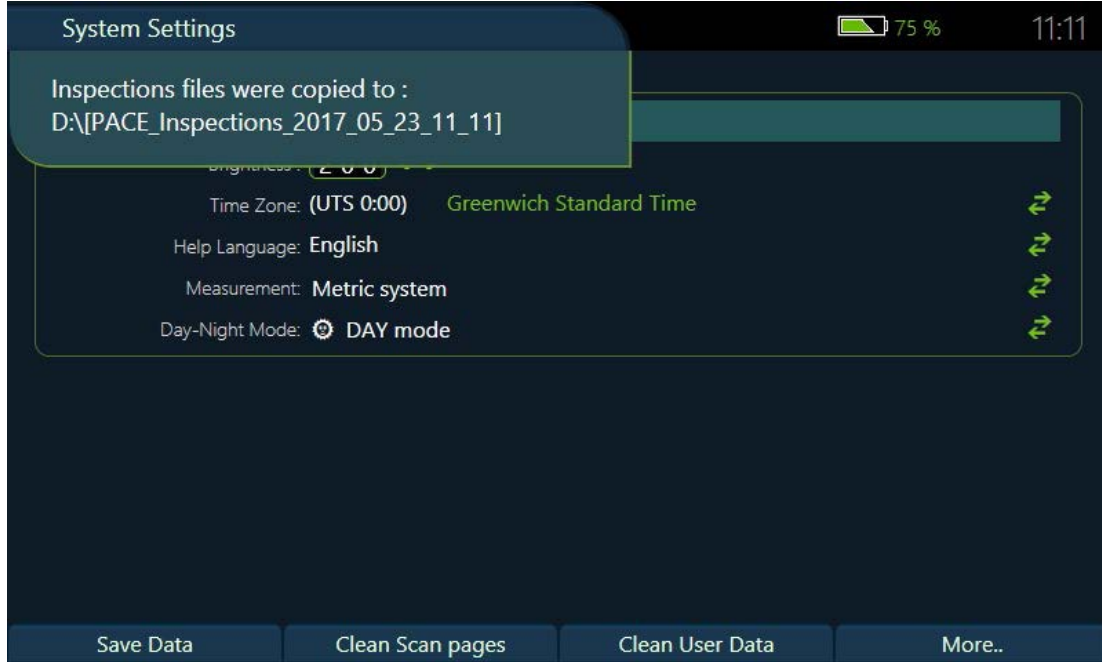
- The measurement setting switches between metric and imperial units.
- Day-night mode switches the Data screen from the daytime bright screen to a dimmer night mode.

Data Backup

After an inspection, all the scan pages, photos and reports can be saved to a USB stick from the System Settings menu.

With a USB attached, pressing the **F1** button “**Save Data**” will save the scan files to the USB.

Figure 21 Saving Data



Clearing Scan Pages and Information

After data backup, it is possible to delete the scan pages and job setup information from the system. From the system settings menu pressing the **F2** button “**Clean Scan pages**” and **F3** button “**Clean User data**” will delete the scan pages and job setup information respectively.

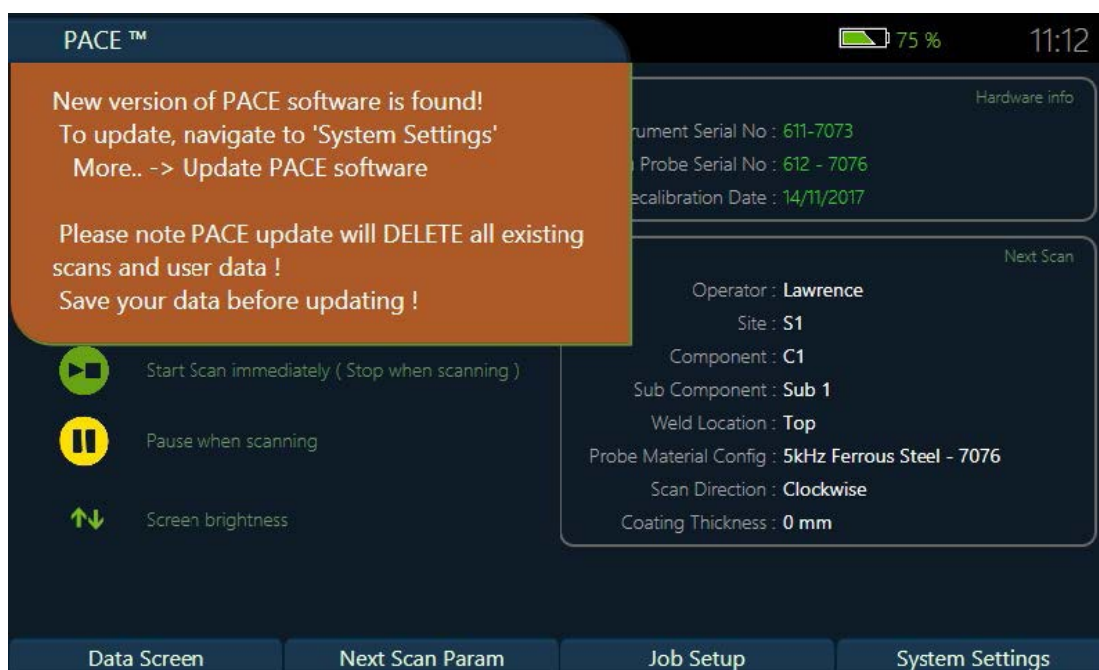
Restoring Lost Data

If for any reason the scan data or job setup information is lost before a backup is performed, it is possible to restore the lost data from the hard drive. In System Setting, pressing the **F4** button “**More**” then “**Restore Scans**” will restore the scan database.

Software Update

It is possible to update the PACE™ software to a newer version or reinstall the current version from the System Settings. With the USB stick with the PACE™ software inserted, pressing the **F4** button “More” then “Update Software” will initiate the installation process.

Figure 22 PACE™ Software Update



Note: that a software update will delete all scan pages and job setup information on the PACE™ unit

Note: It is recommended to back up the data before a software update.

Troubleshooting

Software Crash on Start-up

On instrument start-up, if the software fails to load or displays an error message, attempt to resolve the issue by restarting the instrument.

If the same error occurs, it is possible to rebuild the software by pressing and holding the power button for 15 seconds.

If a software rebuild does not resolve the problem, it is possible to reinstall a fresh version of the PACE™ software from the PACE™ Software Factory Default USB.

Turn off the PACE™ instrument and insert the USB stick before powering the instrument again.

A window should display and guide you through the reinstall process.

High Temperature Warning

If the operating temperature of the instrument gets too hot a warning message will display informing the operator that the instrument will auto-shutdown in 1 minute. It is recommended the user stops scanning and save the data before the auto-shutdown. Steps should be taken to cool down the instrument.

While it is possible to use the instrument while it is charging, this is not recommended as it is highly likely to make the instrument too hot and induce a high temperature warning.

Low Battery Warning

If the battery level of the instrument reaches 5% a warning message will display informing the operator that the instrument will auto-shutdown in 1 minute. It is recommended the user stops scanning and save the data before the auto-shutdown. The instrument should be placed on charge before any further inspections are to be carried out.

For more troubleshooting please consult the User Manual or contact the manufacturer.

Safety and Care Information

General Safety Information



People with Heart Pacemaker

- SENSU™ probes generate electromagnetic fields which can interfere with electronic devices (like heart pacemakers), which could cause them to malfunction. It is therefore not suited for persons with heart pacemakers.

Power Cords and Adaptors:

- Do not connect the AC Power Adaptor to any other devices.
- Do not use the AC Power Adaptor or the Cord if it appears to have damage.
- The Power Cord supplied with the instrument AC Power Adapter should match the plug and voltage requirements for your country. However, if you travel to a different area and need to connect to a different outlet or voltage, make sure you choose a Power Cord with correct power ratings or use a TSC approved Power Cord.



Battery Safety:

- Do not use any other batteries other than the one provided by TSC with the instrument.
- Only use the provided Power Adaptors to charge the battery.
- To avoid risk of fire, burns, or damage to your battery pack, avoid shorting the battery.
- Do not disassemble or deform the battery. There are no serviceable parts inside.
- Do not dispose of the battery pack in fire or water.
- Handle a damaged or leaking battery with extreme care. If you come in contact with electrolyte, wash the exposed area with soap and water. If it contacts the eye, flush the eye with water for 15 minutes and seek medical attention.
- Avoid excessive physical shock or vibration.
- Do not expose the battery pack to high storage temperatures (above 45° C, 113° F). Store in a cool (<21° C), dry and well-ventilated area.
- Do not leave the battery inside the instrument when not in use for long period of time, take it out of the instrument and cover the terminals with the provided battery cover and store it.
- When discarding a battery pack, contact your local waste disposal provider regarding local restrictions on the disposal or recycling of batteries.
- To obtain a replacement battery, contact your local dealer or TSC sales office.
- Do not charge the battery pack if the ambient temperature exceeds 45° C (113° F).
- Stop using the battery if you notice any of the following problems: odour, change in colour, too much heat, change in shape/damage, leaking, odd noises.
- Never use a battery that appears to have suffered abuse.
- Keep out of the reach of children.



LCD Safety:

- If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

Taking care of your instrument

General care:

- Do not cover the heatsink while the instrument is in use.
- Do not submerge the instrument or the probe in water or any other liquids.
- Do not subject the instrument to magnetic fields.
- Do not subject the instrument to heavy shock or vibration.

Cleaning the Instrument:

- Before you clean your Instrument, disconnect the Instrument from the electrical outlet and remove any installed batteries. Clean your Instrument with a soft cloth dampened with water. Do not use liquid or aerosol cleaners, which may contain flammable substances.
- To avoid damaging the instrument display, do not spray cleaning solution directly onto the display. Only use products designed for cleaning displays. Moisten a soft, lint-free cloth with either water or a display cleaner, and wipe the display till it is clean.

The information in this document is accurate as of its publication. Actual products may differ from those presented herein.

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