

SILVERWING SWIFT SCORPION2 & R-SCAN User's Manual



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Swift, Scorpion2 and R-Scan User's Manual

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This manual is part of the original documentation supplied with the Swift instrument, the Scorpion2 crawler and the R-Scan scanning head.

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General Precautions and Conventions

General Precautions

The following safety precautions are to be observed at all times when using the Swift instrument with the Scorpion2 crawler or R-Scan scanning head. Please review them before turning on the system.

- Keep this document in a safe place for future reference.
- Carefully follow the installation and operation procedures detailed herein.
- Observe all warnings, notes and instructions as marked on the packaging, the instrument, the crawler, and detailed in the user's manual.
- Comply with all appropriate safety measures.
- For transportation, ensure all correct safety precautions are followed as dictated by the relevant local governing bodies.
- Swift instrument, Scorpion2 crawler and R-Scan scanning head should only be used by qualified personnel.
- The equipment must not be used for purposes other than those intended. Eddyfi assumes no responsibility for any damage resulting from such improper usage.
- Only connect the system to a power source corresponding to the type indicated on the rating plate.
- Do not use substitute parts or perform unauthorized modifications to the system.
- Ensure the equipment is always in safe operation condition. Qualified staff shall perform functional tests and checks for damage at regular intervals. Authorized staff only shall do disassembly, and according to operation instructions only.
- Ensure by regular checks that the working site, equipment and environments are kept in a clean and clearly arranged state.
- Rules and regulations regarding the prevention of accidents that apply to the working site should be observed.
- If the system does not operate normally, please refer to the service and troubleshooting instructions, or contact Eddyfi for assistance.

Safety Precautions

During operation of the Swift instrument with the Scorpion2 crawler or R-Scan scanning head, observe the safety warnings and precautions.

Rear Stand

Because Swift is a portable system, it is designed to be used under tough conditions. It is, however, not indestructible. To avoid damaging Swift, use its rear stand when operating Swift in a tilted position. Do not use Swift in the upright position, as it may topple over or fall off the work surface.

Conventions

Typographical

The following typographical conventions are used throughout this document:

Italic

Used for file names and paths.

Bold

Used to indicate menu items, named user interfaces, and place emphasis on specific words or phrases. Items in bold type are capitalized to reflect the actual interface.

Marking and Symbols

The following symbols appear on the system and pertain to safety regulations that should be carefully observed:



This label is used as a general warning sign. Always refer to the user's manual to obtain the necessary information for proper protection of the instrument and its users.



This label is used to indicate the presence of strong magnets that generate magnetic fields. Always refer to the user's manual to ensure proper protection and safety.



This label is used to indicate that a falling object hazard is present. Always refer to the user's manual to ensure correct protection and safety.



The RoHS compliance logo signifies that this product complies with the Restriction of Hazardous Substances directive 2002/95/EC. This directive restricts the use of lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyl, and polybrominated diphenyl ether in certain classes of electrical and electronic units as of July 1, 2006.



Swift, Scorpion 2 crawler and R-Scan scanning head are designed to meet the safety requirements in accordance with electrical safety and electromagnetic compatibility. It has been tested and has left the factory in a condition in which it is safe to operate. The equipment is in conformity with the statutory requirements of the EC directive and complies with the following provisions of Low Voltage Directive 2006/95/EC and the Electromagnetic Compatibility Directive 2004/108/EC.



This label acts as a reminder that you should dispose of this system in accordance with your local Waste Electrical and Electronic Equipment (WEEE) regulations. This system was manufactured to the high quality standards of Eddyfi to ensure safe and reliable operation when it is used as stated in this document. Due to its nature, this instrument may contain small quantities of substances known to be hazardous to the environment and to human health if released in the environment. As such, systems falling under WEEE regulations should not be disposed of in the public waste stream.

Safety Indications in This Document

The safety indications in this document are intended to ensure operator safety and the integrity of the system.

DANGER!



Danger statements are a description of an imminent hazardous procedure or a practice (or the like) that, if performed incorrectly, can result in severe injury or death if not avoided and should be limited to the most extreme situations. Do not ignore danger indications, ensure the condition is understood before proceeding.

WARNING!



Warning statements are a description of a potentially hazardous procedure or a practice (or the like) that, if not avoided or if performed incorrectly, could result in injury. Do not ignore warning indications, ensure the condition is understood before proceeding.

CAUTION!



Caution statements are a description of a potentially hazardous procedure or a practice (or the like) that, if not avoided or if performed incorrectly, could result in material damage, loss of data, or both. Do not ignore warning indications, ensure the condition is understood before proceeding.

READ MANUAL



Swift system is designed for a specific use. Using Swift system outside of its intended use is dangerous. Severe injury or death could result. Read and understand this manual before use.

DANGER FALLING OBJECT HAZARD



Failure to comply with the warnings, instructions, and specifications in this manual could result in SEVERE INJURY or DEATH.

Keep the area below an operating crawler clear at all times. A NO ENTRY ZONE must be clearly marked and cordoned off all directions directly below the crawler.

DANGER TETHER LINE



A suitable safety line must be attached to the attachment points of Scorpion2 crawler at all times during operation. Attach the tether line BEFORE placing Scorpion2 crawler onto the inspection surface.

WARNING MAGNETIC MATERIAL



Due to magnetic material, consult IATA documentation before air shipping.

The wheels and probe holder of the crawler contain strong magnets that produce an extremely strong magnetic field which may cause failure or permanent damage to items such as watches, memory devices, CRT monitors, and medical or other electronics devices.



Strong magnetic fields pose a variety of risks, especially to people who wear implanted cardiac devices like pacemakers and defibrillators.



WARNING FINGER TRAP

Tools, magnets, and metal objects can cut, pinch, or entrap hands and fingers. **HANDLE WITH CARE.** People with pacemakers or ICD's must stay at least 2 m (6.5 ft) away.



WARNING RISK OF EXPLOSION

Damage to the crawler and/or cables during or prior to use may cause explosion or fire.

IMPORTANT

Calls the attention to information important to completing tasks.

NOTE

Calls the attention to an operating procedure, a practice, or the like that requires special attention.

EMC Directive Compliance

FCC Compliance (USA)

This equipment was tested and found to comply with the limits for a Class A digital device, pursuant Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user's guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case you will be required to correct the interference at your own expense.

ICES Compliance (Canada)

This ISM device complies with Canadian ICES-001.

AS/NZS Compliance (Australia/New Zealand)

This device complies with Australia and New Zealand AS/NZS 4252.2 (IEC 61000-6-4) and AS/NZS61000-6-2 (IEC 61000-6-2).

Calibration and Warranty Seals

The calibration seal is at the back of the instrument. Swift is also equipped with a warranty seal.

Important

Broken seals void the calibration certification and product warranty.

Limited Warranty

Eddyfi warrants the hardware to be free of any defects in materials or workmanship for a period of twelve (12) months from the date of delivery, under normal use and service. These warranties are limited to the original purchase of the product and are not transferable.

Eddyfi will repair or replace any product component or documentation, at its option and at no additional charge, if found defective within the warranty period. The purchaser is responsible for returning the product to Eddyfi.

Eddyfi will not be held responsible in any way whatsoever for damage resulting from improper installation, accident, misuse, or from service or modification of the product by anyone other than Eddyfi, or an authorized Eddyfi service center.

Eddyfi will not be held responsible in any way whatsoever for direct, indirect, special, incidental, or consequential damages resulting from possession, use, improper installation, accident, service, modification, or malfunction of the product (including, without limitation, damages for loss of business profits, business interruption, loss of business information, or other pecuniary loss). Eddyfi's total shall in no event exceed the purchase price of the applicable item(s).

This warranty is in lieu of all other warranties, whether oral, written, expressed, or implied, including any warranty of merchantability or fitness for a particular purpose, and no other representation or claims of any nature shall be binding on or obligate Eddyfi.

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

Chapter 1

Swift Overview

Introducing Swift

Swift is a battery-powered Ultrasonic Data Acquisition instrument with dedicated B-Scan software designed to capture the Ultrasonic data from both R-Scan scanning head and Scorpion2 crawler. Swift is also used to control the movement and speed of the Scorpion2 crawler.

What's in the Box

Swift is supplied in a rugged transport case and comes with the following standard accessories:

- Two, high-capacity batteries
- One power adapter (100–240 V)
- Power leads
- Battery charger
- Stylus
- Transport case

Swift Overview

Front

Figure 1-1 Swift front panel overview



1. Power button

Use this button to turn the instrument on and off. The power indication at the center of the button behaves as follows:

- Green: Swift is on
- Flashing yellow / orange: Swift is in standby mode
- Unlit: Swift is off

2. Battery indicator

This displays the state of Swift batteries when the instrument is on. Dependent upon the power mode (mains or battery power) the indicator behaves differently.

Mains power

- Green: batteries fully charged
- Flashing green: batteries charging
- Red: battery or charger error
- Unlit: no batteries in Swift

Battery power

- Unlit: remaining charge over 40%
- Orange: remaining charge 20–40%
- Flashing yellow: remaining charge less than 20%
- Red: battery error

3. Wi-Fi indicator

This displays the Wi-Fi status of Swift:

- Green: Wi-Fi enabled
- Unlit: Wi-Fi disabled

4. Alarm indicator

This indicator is used to display user-programmed errors. The indicator remains unlit until it detects a predefined error condition.

5. Backwards nudge

Hold this button to drive Scorpion2 crawler backwards.

6. Stop movement

Press this button to stop Scorpion2 crawler and end the data acquisition scan.

7. Forwards nudge

Hold this button to drive Scorpion2 crawler forwards.

8. Joystick

This is used to drive and steer Scorpion2 crawler when a connection is established.

The movement of the crawler depends upon the joystick status indicated in Swift software.

Joystick: Enabled

This allows both drive and steer control over the crawler.

Joystick: Rotation lock ON

This allows only forwards and backwards movement of the crawler with slight veering control to adjust driving direction.

Joystick: Disabled

The joystick will not move the crawler.

9. Heavy-duty bumpers

The four corner bumpers provide shock absorption and support Swift at an angle when set on a flat surface. The bumpers also act as a harnessing point for the instrument. For details about harnessing, see Appendix A.

10. Multi-touch display

10.4", non-reflective, backlit, high-resolution display.

11. Handle

Use this handle when carrying Swift.

12. Back button

Press this button to navigate backwards through Swift software interface.

13. Keypad arrows

The use of the arrows is dependent upon the view in Swift software interface.

Up/Down arrow

In A-Scan Configuration view, these adjust the step/pre-set value of the selected A-Scan property.

In Analyse view, they control the vertical crosshair cursor position on the B-Scan.

Left/Right arrow

In A-Scan Configuration view, these arrows increase or decrease the selected A-Scan property by the step/pre-set value.

In Analyse view, they control the horizontal crosshair cursor on the B-Scan.

14. Enter button

Use this button to select OK, or Yes to any confirmation windows.

When in the A-Scan Configurations view press this button to apply the step/ preset value to the selected A-Scan property.

15. Start/Pause scan button

Use this button to start or pause the data acquisition scan.

16. Stop scan button

Use this button to finish the data acquisition scan.

17. Zoom in

Use this button to zoom in on the B-Scan in Analysis view.

18. Zoom out

Use this button to zoom out of the B-Scan in Analysis view.

Right

Figure 1–2 Swift right panel overview



1. UT connectors

Use these connectors for the ultrasonic transmit and receive connectors of the umbilical for the Scorpion2 or R-Scan.

2. I/O connector

Use this connector for the umbilical for the Scorpion2 or R-Scan. It is used for data communication to the Scorpion2 and encoder communication for the R-Scan.

3. Emergency Stop

Use this to disconnect data communication and power to Scorpion2 and encoder communication for the R-Scan.

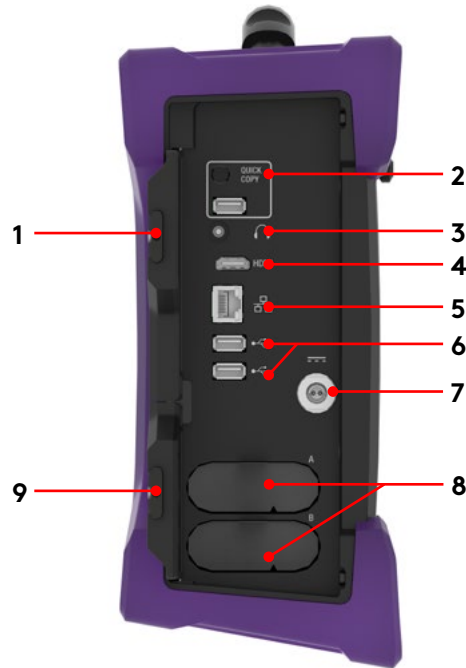
When pressed the Emergency Stop status is indicated in Swift software.

Emergency Stop ON

Reset by rotating clockwise.

Left

Figure 1–3 Swift left panel overview



1. Protective connector door

Protects Swift’s powerful connectivity from the elements when they are not in use.

2. Quick Copy Button

Not currently supported on Swift.

3. Audio connector

Not currently supported on Swift.

4. HDMI® connector

Use this to connect an external monitor to Swift.

5. Network connector

Use this connector to hook up Swift to a local area network (LAN). This connector is equipped with two indicators with the following behavior:

Connection indicator (upper)

- Green: communication established between Swift and the network
- Flashing green: activity between Swift and the network
- Unlit: no link to network

Connection speed indicator (lower)

- Amber: operating at a gigabit connection (1Gbps)
- Green: operating at a 100 Mbps connection
- Off: operating at a 10 Mbps connection

6. USB 2.0 connectors

Use these to connect USB devices to Swift, such as a mouse or external disk drive.

7. Power connector

Use the AC power adaptor to recharge the batteries.

8. Battery compartments

Insert the supplied batteries into the appropriate battery compartment.

9. Protective battery compartment door

Protects the battery compartments from the elements.

Rear

Figure 1–4 Swift back panel overview



1. Instrument stand

This stand retracts outwards to hold Swift at an angle, preventing the instrument from falling over horizontally.

Positioning Swift

Swift must be properly positioned prior to use so as to reduce the likelihood of the instrument dropping or falling over. Swift has two safe operating positions, horizontal and tilted. To use Swift in the tilted position, simply pull out the stand located at the rear of the instrument until Swift is at the desired angle. Swift can be used with an optional harness, see Appendix A for further details.

Figure 1–5 Swift in the horizontal position



Figure 1–6 Swift in the tilted position



Caution

It is possible to use Swift whilst placed on its lower bumpers, however this is not a safe operational position since the instrument may fall over. To operate Swift at an angle, ensure that the stand located at the rear of the instrument is used.

Important

Regardless of how the instrument is positioned, it must always have a minimum clearance of 10cm (4in) on all sides of the instrument. Always position the instrument away from heat sources. This ensures proper heat dissipation while the instrument is in use.

Starting Swift

Proceed as follows to turn on your instrument or exit the standby mode:

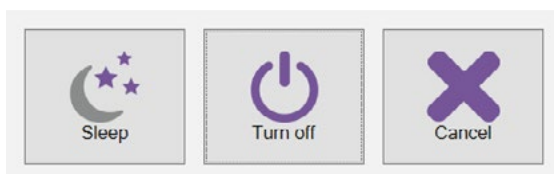
1. Make sure that at least one of the two batteries is inserted into the battery compartment of the instrument, or that the instrument is connected to an external power source using the supplied power cord.
2. Press the power button.
3. The power indicator at the center of the power button lights green.

Shutting Down Swift

Proceed as follows to shut down your instrument:

1. Save all your data.
2. Press the power button.
Three option buttons appear on the display.

Figure 1-7 Shutting down Swift



3. Tap the **Turn off**.
The instrument shuts down.

Batteries

Swift can be used under battery power. It is designed with two battery cradles under the protective battery compartment door, but can be powered by a single battery. Swift uses Li204SX-7800 lithium-ion rechargeable batteries from Emerging Power, which do not suffer from the memory effect affecting previous generations of batteries. Each battery has an 'always on' 5 bar LCD state of charge bar graph to indicate estimated remaining battery life.



WARNING!

When transporting Swift, it is the responsibility of the user to ensure the safety precautions used are in accordance with the local department of transportation (or equivalent governing body) rules and regulations.

When carrying or transporting Swift in its transit case, remove the batteries from the instrument and ensure they cannot come in contact during transport, as this poses a significant fire and explosion hazard. Swift transit case comes with slots fitted to receive the batteries once removed from the instrument.

Do not replace the batteries for any battery other than Li204X-7800 lithium-ion rechargeable batteries from Emerging Power

Inserting/Removing Batteries

Inserting Batteries

1. On the left side of Swift, unlatch the battery compartment door, then open.
2. Align your battery with one of the battery cradles.

Note: Battery cradles are marked A and B. If inserting only one battery it does not matter which cradle is used.

3. Make sure that the battery contacts are facing inward and upward.
4. Slide the battery into the battery cradle until it is fully inserted.
5. Close the battery compartment door and secure the latch.

Removing Batteries

1. On the left side of Swift, unlatch the battery compartment door, then open.
2. Grab the battery tab between thumb and forefinger.
3. Pull on the tab to release the battery contacts.
4. Slide the battery out of its cradle.

Hot Swapping Batteries

It is possible to remove one battery from Swift when it is powered on as the instrument can operate on a single battery. If the power in the remaining battery is insufficient to keep Swift powered on, the instrument shuts down without damaging electronic components. Any work in progress in Swift software (acquisition, etc.) is lost.

Battery Charging

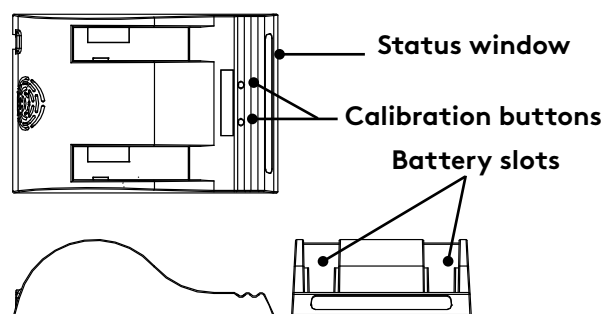
Swift batteries recharge automatically when they are in the instrument and the AC adaptor is connected to the power outlet and turned on. The battery indicator on the lower-left keypad displays information about the battery charge. Swift software also features a battery charge indicator.

Note: Batteries do not recharge when their internal temperature exceeds 45°C (113°F). Batteries also do not power Swift when the instrument's internal temperature exceeds 55°C (131°F).

Using the Battery Charger

Note: Swift batteries can also be charged in an external battery charger. This charger conditions and calibrates the instrument's batteries, which is important in maximizing battery life.

Figure 1–8 Optional battery charger



To charge the batteries with the optional charger:

1. Place the charger on a flat and level surface, away from heat and moisture sources.
2. Insert the power supply's DC connector into the back of the external charger.
3. Connect the power supply to an AC supply using the supplied cable.
All the LEDs flash momentarily to let you know that power is present.
4. Insert the batteries into the battery slots while making sure that the contacts are fully seated.

The charger automatically begins charging the batteries and the LEDs in the status window display the following information:

- Flashing green: battery charging
- Green: battery fully charged
- Flashing blue: battery calibrating
- Blue: battery charge gauge calibrated
- Flashing red: battery charge gauge in need of calibration
- Red: error

Calibrating Batteries

To ensure that your batteries perform at their full capacity for the longest possible time, it is important to calibrate them on a regular basis. Calibration involves a standard battery charge followed by a deep discharge, and then a complete charge.

It is recommended that batteries are calibrated every six months. This procedure usually takes 10 to 13 hours, whereas a standard charge only takes approximately 3.5 hours.

To calibrate batteries, place them in the charger and then press the calibration button.

Storing Batteries



Whenever transporting Swift in its case, remove the batteries from the instrument, place them in plastic bags and ensure they cannot come into contact during transport since they pose a significant fire and explosion hazard.

Swift transport case is outfitted with two slots intended for the batteries. We recommend that they are taken advantage of.

Chapter 2

Scorpion2 Overview

Introducing Scorpion2

Scorpion2 crawler is designed for B-Scan inspection of ferrous plate ranging from a diameter of 3 m (10 ft) diameter up to flat plate. Scorpion2 has a removable probe head which is fitted with a 5MHz twin crystal dry coupled wheel probe allowing it to inspect material thickness between 2.5mm to 100mm (0.1 in to 4 in). The battery powered crawler is motor driven and can scan at speeds of up to 180 mm/sec (7 in/sec).

Scorpion2 works in conjunction with Swift which provides the dedicated B-Scan software designed to capture the Ultrasonic data and control the movements and speed of the crawler.

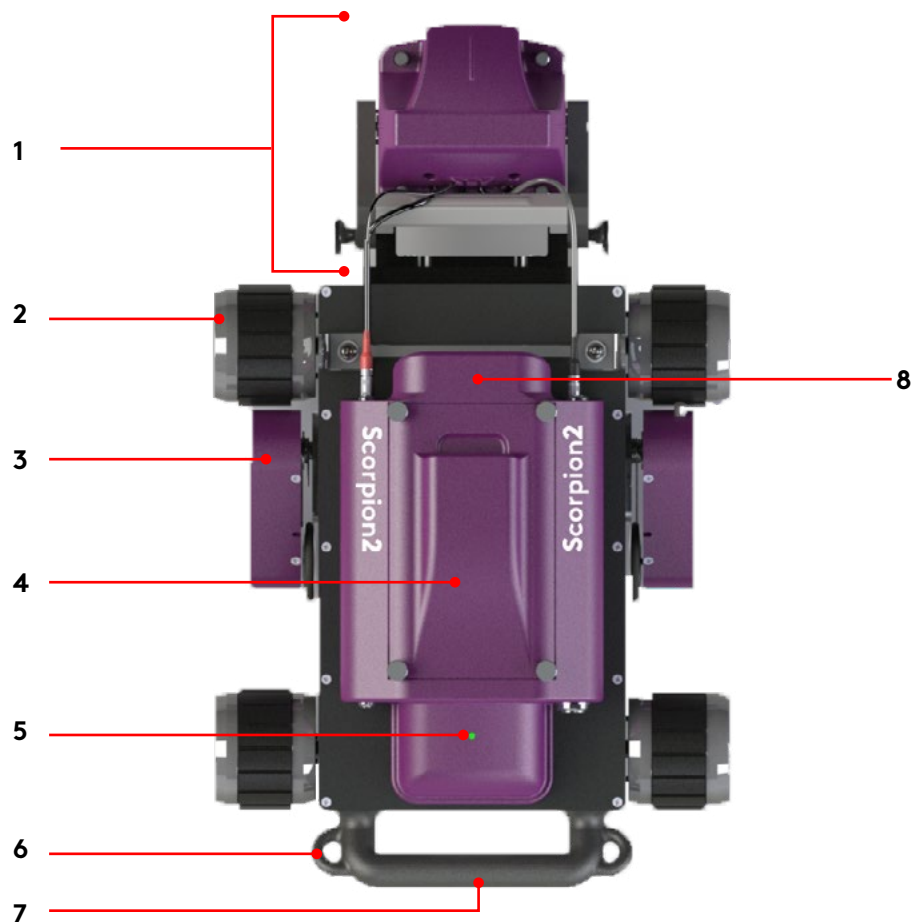
What's in the Box

Scorpion2 is supplied in a rugged transport case and comes with the following standard items:

- Probe head with wheel probe
- Two, high-capacity batteries
- Battery charger
- Umbilical
- Umbilical tail and rubber clip
- Silicone oil and syringe
- Metric hex key set
- Circlip pliers and circlips
- Tether line
- Magnetic drive off sheet

Top View

Figure 2-1 Scorpion2 top view



1. Probe head

The probe head at the front of the crawler is designed to magnetically adhere to the inspection surface, or when lifted fully upwards adhere to the front of Scorpion2 crawler.

2. Magnetic drive wheels

The four drive wheels provide magnetic attraction to the inspection surface. Each wheel is independently controlled, allowing full steering control over the crawler.

3. Encoders

During an automatic mode scan, the crawler relies on both encoders to actively steer the crawler. The right encoder is used to record the distance travelled in either scanning mode.

4. Battery lid

A sealed battery cover with captive thumb screws protects the battery compartment from the elements.

5. LED indicator

This displays the communication state between Scorpion2 crawler and Swift. The LED displays the following information:

- Green: Power on and communication with Swift
- Red flashing: Power on but no communication with Swift
- Blue: Scorpion2 firmware read/write status
- Off: No power to Scorpion2

6. Umbilical tether

Use this to attach the tether of the umbilical and avoid unwanted strain on Scorpion2 connectors.

7. Rear carry handle

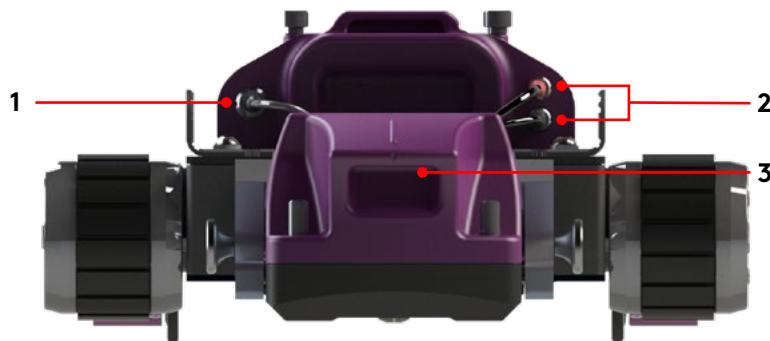
Use this to lift and carry Scorpion2 crawler.

8. Top carry handle

Use this to lift and carry Scorpion2 crawler.

Front View

Figure 2–2 Scorpion2 front view



1. Wheel Probe linear actuator connector

Use this connector for the wheel probe linear actuators found within the probe head. Linear actuators automatically lift the wheel probe away from the inspection surface when not performing a data acquisition scan.

2. Wheel probe UT connectors

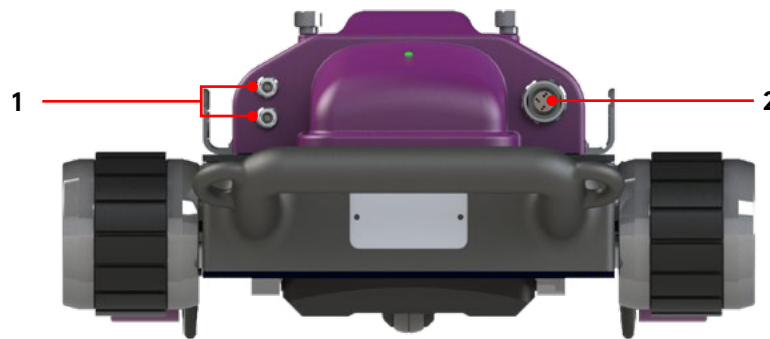
Use these connectors for the ultrasonic transmit and receive connectors of the wheel probe.

3. Probe head lifting handle

Use this to raise and lower the probe head.

Rear View

Figure 2–3 Scorpion2 rear view



1. Umbilical UT connectors

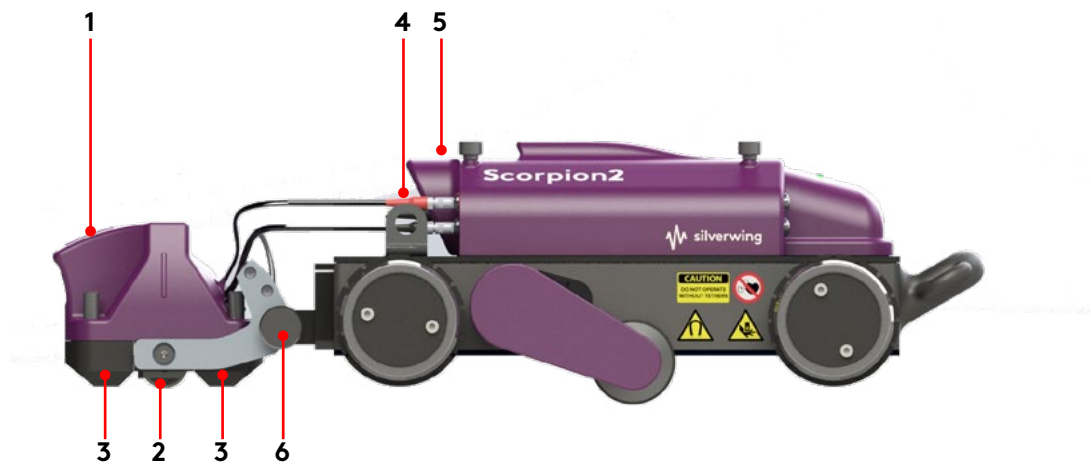
Use these connectors for the ultrasonic transmit and receive connectors of the umbilical to the Swift.

2. Umbilical I/O connector

Use this connector for the umbilical to provide data communication with Swift.

Side view

Figure 2–4 Scorpion2 side view



1. Probe head lifting handle

Use this to raise and lower the probe head.

2. Ultrasonic wheel probe

5MHz twin crystal dry coupled wheel probe.

3. Wear runners

Removable wear runners that are in constant contact with the inspection surface.

4. Tether line attachments

Use these to attach the tether line during the inspection.

5. Top carry handle

Use this to lift and carry Scorpion2 crawler.

6. Probe head plunge pins

Pull the probe head plungers outward to connect and remove the probe head from the Scorpion2 crawler body.

Batteries

Scorpion2 uses an NH2054 HD31 14.4V Lithium Ion smart battery from Inspired Energy. Each battery has an 'always on' 5 bar LCD state of charge bar graph to indicate estimated remaining battery life.



WARNING!

When transporting Scorpion2, it is the responsibility of the user to ensure the safety precautions used are in accordance with the local department of transportation (or equivalent governing body) rules and regulations.

When transporting Scorpion2 in its transit case, remove the batteries from the crawler and ensure they cannot come in contact during transport, as this poses a significant fire and explosion hazard.

Scorpion2 transit case comes with slots, fitted to receive the batteries once removed from the crawler.

Note

Do not replace the batteries for any battery other than NL2054 HD31 Lithium-Ion batteries from Inspired Energy.

Inserting/Removing Batteries

Inserting Batteries

1. On the lid of Scorpion2, unscrew the four thumb screws and remove the battery compartment lid.
2. Make sure that the battery contacts are facing inwards and downwards.
3. Secure the battery compartment lid using the thumb screws.

Figure 2-5 Scorpion2 inserting batteries



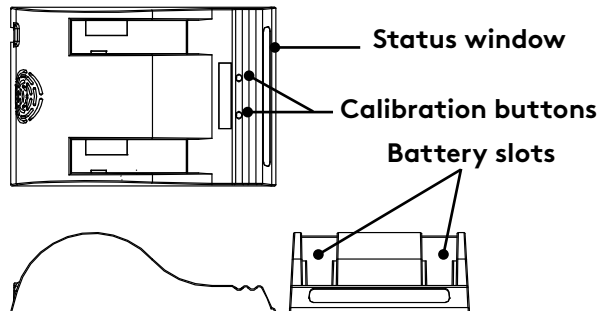
Removing Batteries

1. On the lid of Scorpion2, unscrew the four thumb screws and remove the battery compartment lid.
2. Grab the battery tab between thumb and forefinger then pull upwards to release.

Battery Charging

Scorpion2 batteries must be charged using the external battery charger. This charger conditions and calibrates the instrument's batteries, which is important to maximize their lives. We recommend calibrating the batteries every six months.

Figure 2-6 Battery charger



To charge the batteries with the charger:

1. Place the charger on a flat and level surface, away from heat and moisture sources.
2. Insert the power supply's DC connector into the back of the external charger.
3. Connect the power supply to an AC supply using the supplied cable.
All the LEDs flash momentarily to let you know that power is present.
4. Insert the batteries into the battery slots while making sure that the contacts are fully seated.

The charger automatically begins charging the batteries and the LEDs in the status window display the following information:

- Flashing green: battery charging
- Green: battery fully charged
- Flashing blue: battery calibrating
- Blue: battery charge gauge calibrated
- Flashing red: battery charge gauge in need of calibration
- Red: error

Calibrating Batteries

To ensure that your batteries perform at their full capacity for the longest possible time, it is important to calibrate them on a regular basis. Calibration involves a standard battery charge followed by a deep discharge, and then a complete charge.

It is recommended that batteries are calibrated every six months. This procedure usually takes 10 to 13 hours, whereas a standard charge only takes approximately 3.5 hours.

To calibrate batteries, place them in the charger and then press the calibration button.

Storing Batteries

WARNING



Whenever transporting Scorpion2 in its case, remove the battery from the crawler, place them in plastic bags and ensure they cannot come into contact during transport since they pose a significant fire and explosion hazard.

Scorpion2 transport case is outfitted with two slots intended for the batteries. We recommend that they are taken advantage of.

Preparing Scorpion2

After removing the Scorpion2 from its transit case the probe head needs to be attached to the front of the crawler body.



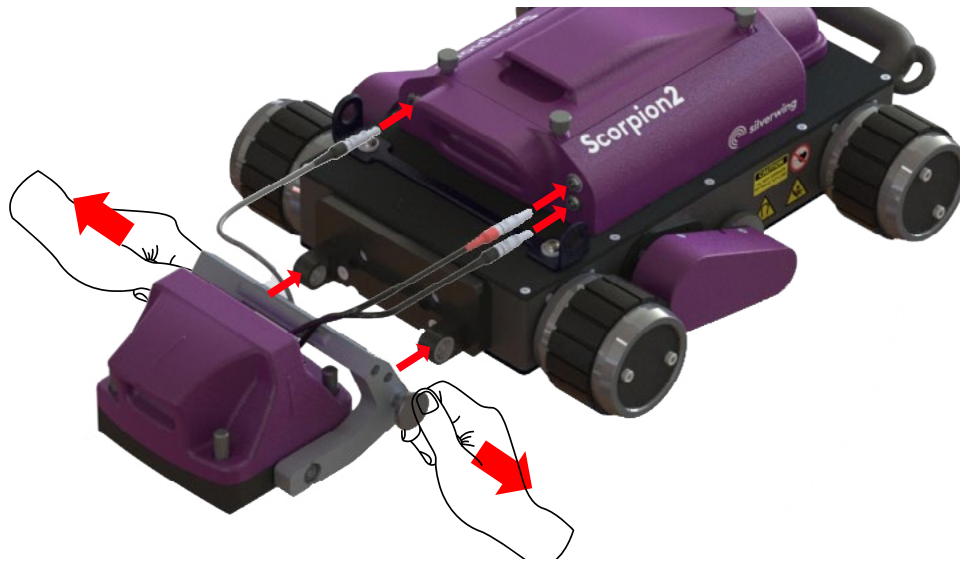
WARNING!

Care must be taken when handling Scorpion2, due to the magnetic pull from the wheels and probe head.

To connect the probe head to the Scorpion2 crawler:

1. Pull the plunger pins on either side of the probe head out outwards.
2. Align the probe head plunger pins with the holes in the bracket mounted on the front of the Scorpion2 crawler.
3. Release the plunger pins to secure the probe head to the crawler body.
4. Connect both ultrasonic wheel probe Lemo00 connectors to the front of Scorpion2 crawler. Ensure the color of the connector boot matches the color ring of the connector on the crawler.
5. Connect the probe head linear actuator Lemo0B connector to the front of Scorpion2 crawler. Ensure the red dot on the connector lines up with the red dot on the bulkhead socket.

Figure 2-7 Connection of the probe head



Before deploying the Scorpion2 it is important to undertake the following checks:

- Validate the system is still within its calibration date.
- Check the system for any damage, including the dry coupled wheel probe, all cabling and connectors.
- Ensure all connectors are securely attached.
- All batteries of the system are fully charged.
- Check the condition of the wear runner and ensure there is no debris around them and the wheel probe holder.
- Ensure the dry coupled wheel probe has been cleaned and sufficient silicone oil applied.
- Ensure the cleaning pad, located behind the dry coupled wheel probe, has sufficient silicone oil applied. If the cleaning pad is dirty then it is recommended to replace.

Figure 2–8 Applying silicone oil to the wheel probe



WARNING!

Only use silicone oil to moisten the cleaning pad. Any other form of mineral oil will damage the wheel probe tires.

The use of any 'oil' other than specified by the manufacturer will invalidate the warranty on the wheel probe tires.

For further information on system maintenance see the Troubleshooting and maintenance section.

Handling Scorpion2

The weight of Scorpion2 unit is 10.5 kg (23 lb). Only lift and carry the crawler using the handles integrated into its body, located on the top of the crawler and at its rear. Before carrying the crawler, ensure the probe head has been fully lifted upwards and is adhered to the front of Scorpion2.



WARNING!

Care must be taken when handling Scorpion2, due to the magnetic pull from the wheels and probe holder.

Figure 2-9 Scorpion2 handling top view

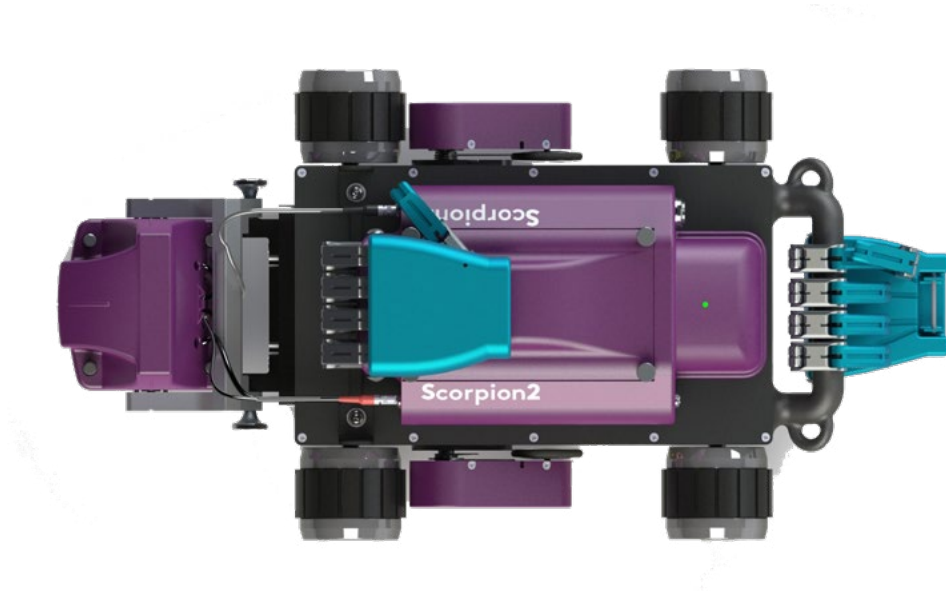


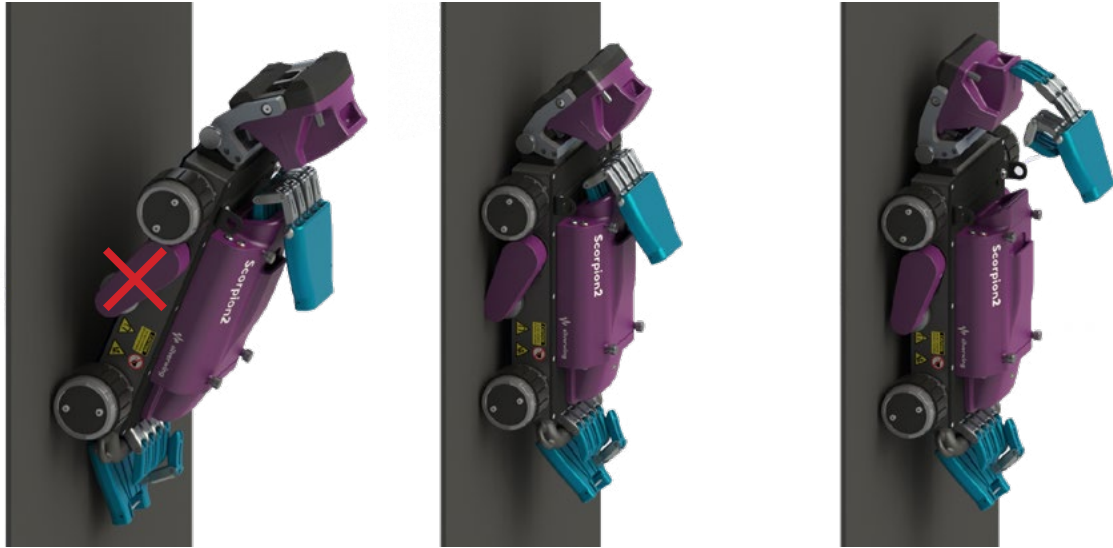
Figure 2-10 Scorpion2 handling isometric view



Deploying Scorpion2 onto the Inspection Surface

Pick up the crawler using the correct handles.

Figure 2-11 Deploying Scorpion2

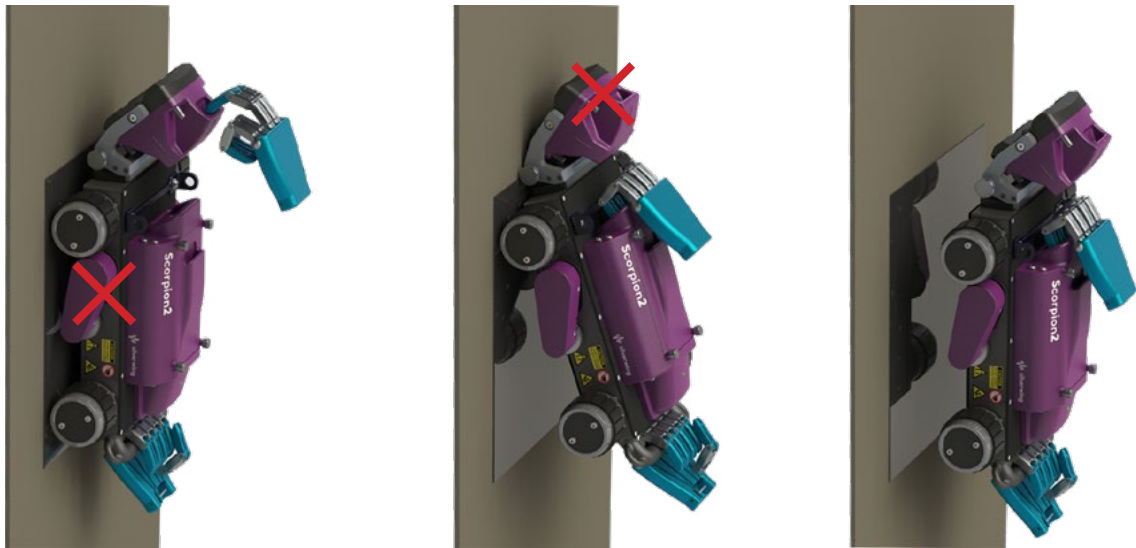


1. Slowly lower the rear wheels of the crawler onto the inspection surface.
2. Slowly lower the front wheels of the crawler onto the inspection surface.
3. Place the probe holder onto the inspection surface.

Removal of Scorpion2 from the Inspection Surface

To remove the crawler from the inspection surface:

Figure 2-12 Removing Scorpion2 from the inspection surface.



1. Place the magnetic drive off pad onto the inspection surface then drive the crawler on to it.
2. Lift the probe head fully upwards away, from the inspection surface.
3. Holding the crawler by the two handles, pull the rear handle away to lift the rear wheels from the inspection surface.
4. Continue until the front wheels lift away from the inspection surface.
5. Use the top handle to pull the crawler away from the inspection surface.
6. Retrieve the magnetic drive off pad.

Use of the Umbilical Tail

The umbilical tail is designed to keep the umbilical cable clear of the crawler especially when the crawler is driven down a vertical inspection surface. The tail attaches to the rear carry handle of the crawler.

To fit the umbilical tail to Scorpion2:

1. Feed the tail up through the bottom of the rear carry handle, then clip it onto the carry handle.
2. Use the black rubber clamp to secure the umbilical cable to the top of the tail.

Figure 2-13 Scorpion2 umbilical tail



To remove the umbilical tail from Scorpion2:

1. Release the black rubber clamp.
2. Lift the tail upwards and remove from the rear carry handle.

Scorpion2 Optional Parts and Accessories

There are a number of optional accessories and spare parts available for the Scorpion2 crawler, and are listed below:

- UT Validation block and holder for thickness measurement verification.
- Consumables kit
- Spare wheel probe tires
- Spare wheel probe transducer

Chapter 3

R-Scan Overview

Introducing R-Scan

R-Scan is a manual, handheld scanner designed for B-Scan inspection of ferrous plate and pipes ranging from 50mm (2in) diameters to flat plate. R-Scan is fitted with a 5MHz twin crystal dry coupled wheel probe allowing it to inspect material thickness between 2.5mm to 100mm (0.1 in to 4 in).

R-Scan works in conjunction with Swift which provides the dedicated B-Scan software designed to capture the Ultrasonic and encoder data from the scanning head.

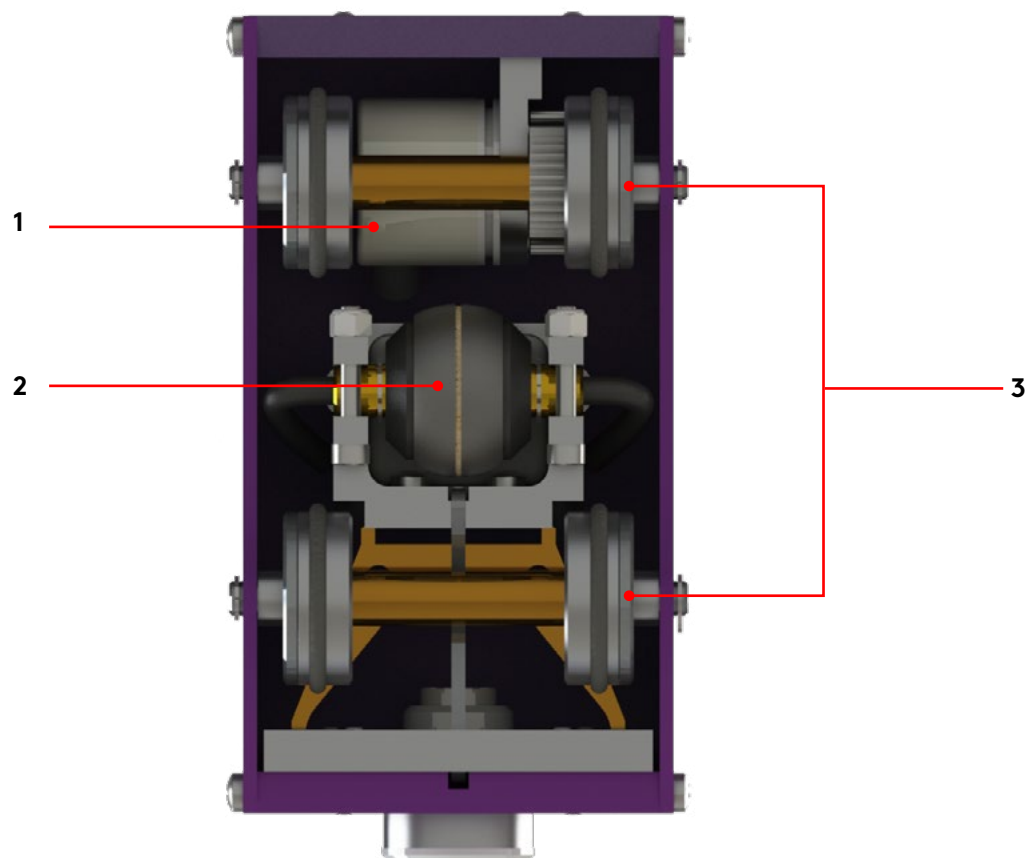
What's in the Box

R-Scan is supplied in a rugged transport case and comes with the following standard items:

- Umbilical
- Silicone oil and syringe
- Lemo extraction tool
- 5.5mm Spanner
- Circlip pliers and circlips
- 2.5mm Hex key

Bottom View

Figure 3-1 R-Scan bottom view



1. Encoders

The encoder is used to record the distance travelled during data capture.

2. Ultrasonic wheel probe

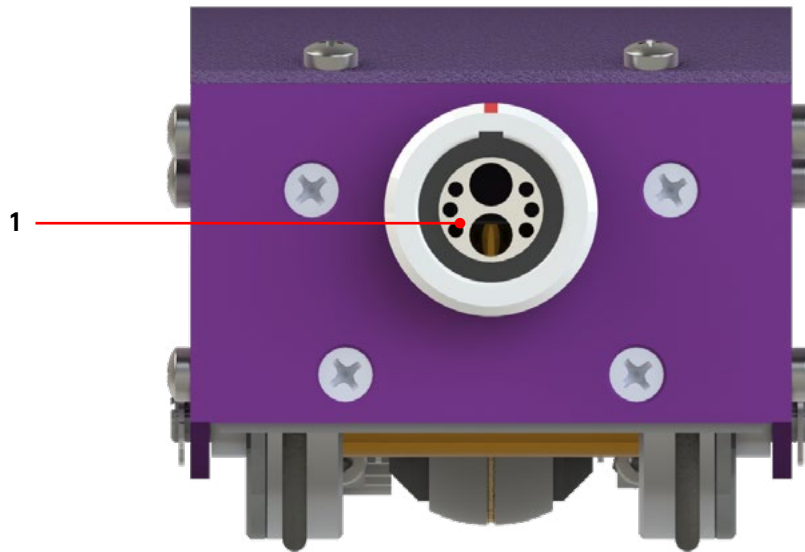
5MHz twin crystal dry coupled wheel probe.

3. Magnetic wheels

Assists while scanning vertically or inverted and minimize the possibility of encoder slippage.

Rear View

Figure 3–2 R-Scan rear view



1. Umbilical connector

Use this connector for the umbilical to provide encoder communication and ultrasonic transmit and receive with Swift.

Preparing R-Scan

Before deploying the R-Scan it is important to undertake the following checks:

- Validate the system is still within its calibration date.
- Check the system for any damage, including the dry coupled wheel probe, all cabling and connectors.
- Ensure all connectors are securely attached.
- All batteries of the system are fully charged.
- Ensure the dry coupled wheel probe has been cleaned and sufficient silicone oil applied.
- Ensure the cleaning pad, located behind the dry coupled wheel probe, has sufficient silicone oil applied. If the cleaning pad is dirty then it is recommended to replace.

Figure 3–3 R-Scan with syringe



**WARNING!**

Only use silicone oil to moisten the cleaning pad. Any other form of mineral oil will damage the wheel probe tires.

The use of any 'oil' other than specified by the manufacturer will invalidate the warranty on the wheel probe tires.

For further information on system maintenance see the Troubleshooting and maintenance section.

Handling R-Scan

The weight of R-Scan unit is 1.8 kg (4 lb). The R-Scan is designed to be held in the palm of a hand with the umbilical connector at the rear of the scanner. The R-Scan can be pushed forward or backward.

Figure 3-4 Handling the R-Scan



R-Scan Optional Parts and Accessories

There are a number of optional accessories and spare parts available for the R-Scan system, and are listed below:

- 6 meter (20 foot) Umbilical
- UT Validation block and holder for thickness measurement verification.
- Consumables kit
- Spare wheel probe tires
- Spare wheel probe transducer

Chapter 4

Software Overview

Introducing Swift Software

Running on Swift is a powerful, easy-to-use data acquisition and analysis software. It is specifically designed for B-Scan ultrasonic inspections and relies on an intuitive wizard to configure setups.

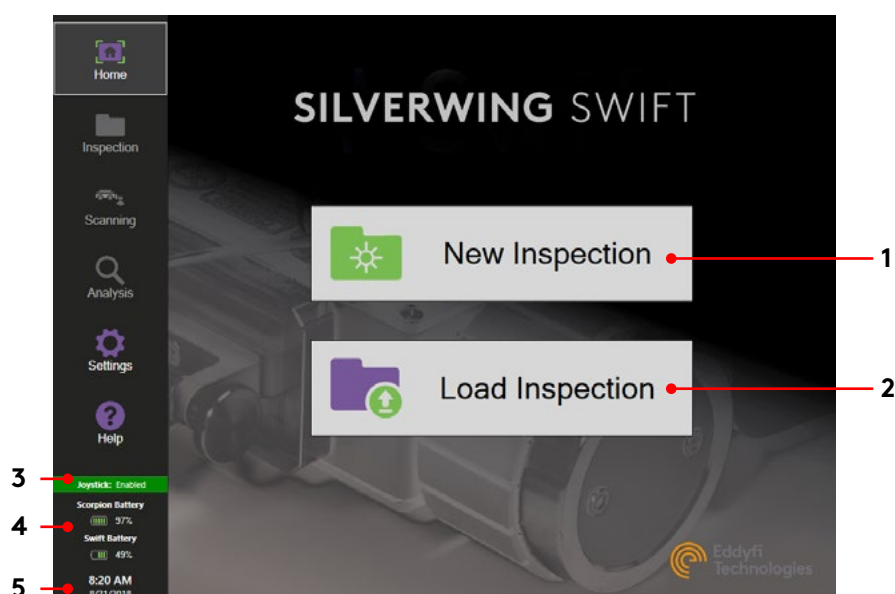
The software benefits from a graphical user interface (GUI) designed to simplify the inspection process. The multi-touch display is the best way of interacting with Swift, however a USB mouse and keyboard can be connected, if required.

On the left hand side of the GUI is a sidebar that provides access to the various windows associated with the setup and progression of an inspection, the inspection setting preferences and status information regarding Swift. A toolbar menu with window specific operational buttons is located at the top of the GUI.

Home

Home allows either a new inspection to be created or a saved inspection on Swift to be loaded.

Figure 4-1 Home view



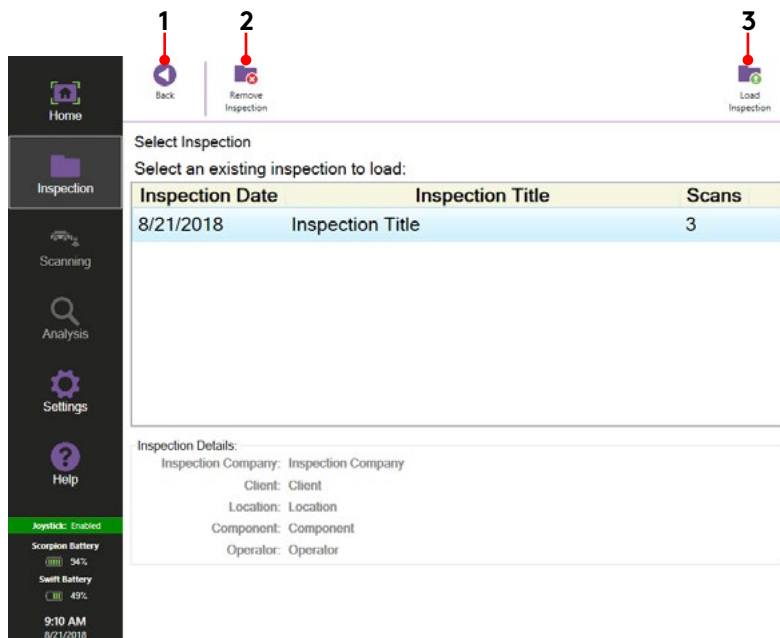
1. **New Inspection**
Tap this button to access the **Inspection Details** window.
2. **Load Inspection**
Tap this button to load an existing inspection saved on Swift.
3. **Joystick and Emergency Stop button Status**
This indicates the joystick and Emergency Stop button status of Swift
4. **Battery Status**
The icons indicate the current battery level of Swift and, when connected, Scorpion2.
5. **Time and Date**
This displays the current time and date.

Inspection

Load Inspection

The Inspection window lists inspections already stored on Swift, details relating to the inspection and the number of scans conducted within the inspection.

Figure 4-2 Inspection window



- 1. Back**
Tap this button to return to the **Home** window.
- 2. Remove Inspection**
Tap this button to delete a selected inspection.
- 3. Load Inspection**
Tap this button to load a selected inspection.

Inspection Details Window

Inspection Details allows information relating to the inspection, the asset, component and material under test to be entered or modified.

Figure 4–3 Inspection details window

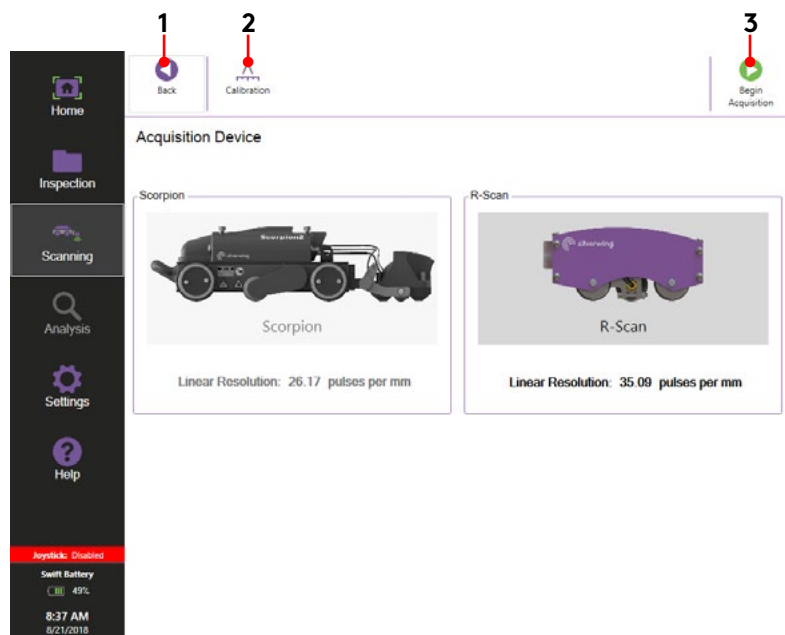
The screenshot shows the 'Inspection Details' window. At the top, there is a horizontal bar with seven numbered callouts (1-7) pointing to buttons: 1. Back, 2. Load Scan, 3. Export Inspection, 4. Export All Scans, 5. Finish Inspection, 6. Clear Details, and 7. Save Details and Begin Scan. Below this bar is a sidebar on the left with icons for Home, Inspection, Scanning, Analysis, Settings, and Help. The main area is divided into sections: 'Inspection' (with fields for Title, Company, Client, Location, Operator, and Date), 'Asset' (with fields for Name, Location, and Type), 'Component' (with fields for Name, Type, Diameter, and Height), and 'Material' (with fields for Type and Shell Thickness). A 'Comments' section is at the bottom left.

1. **Back**
Tap this button to return to the Home window.
2. **Load Scan**
Tap this button to analyse a scan saved within the current inspection.
3. **Export Inspection**
Tap this button to export the current inspection to a USB drive in a CMAP compatible format (CMX).
4. **Export All Scans**
Tap this button to export all the scans within the current inspection to a USB drive. Here thickness measurement data for all scans can be exported in either a CSV file format or a Microsoft Excel Workbook file format.
5. **Finish Inspection**
Tap this button to finish the current inspection.
6. **Clear Details**
Tap this to clear all current inspection details.
7. **Save Details and Begin Scan**
Tap this in order to progress to the setup for scanning.

Acquisition Device window

Acquisition Device indicates which of the available scanning devices, the Scorpion2 crawler or the R-Scan scanning head is connected to Swift. It also contains the setup and calibration details of the encoders for the selected device.

Figure 4–4 Acquisition device window



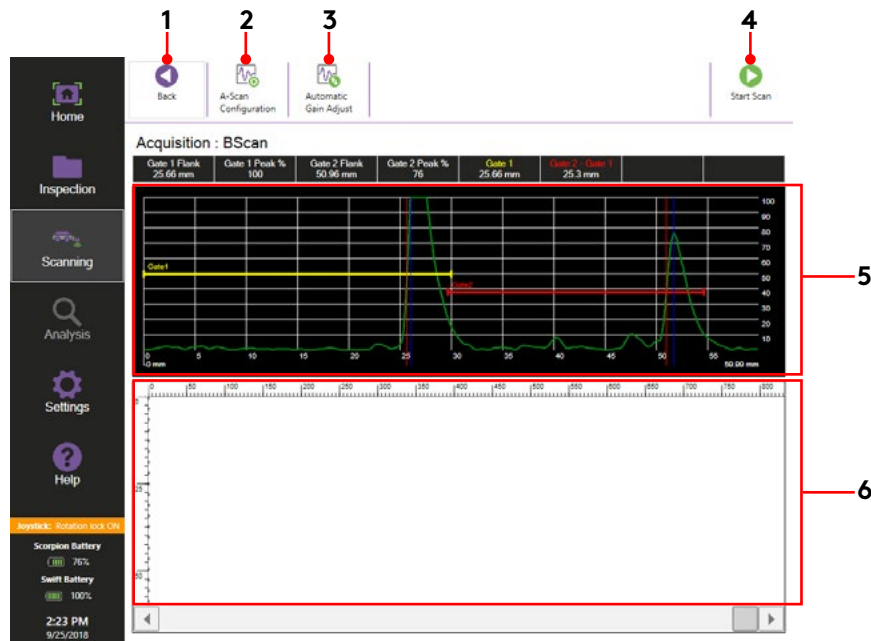
- 1. Back**
Tap this button to return to the **Home** window.
- 2. Calibration**
Tap this button to access the encoder calibration setup.
- 3. Begin Acquisition**
Tap this button to progress to the **Acquisition B-Scan** window.

Scanning

Acquisition: B-Scan window

Acquisition B-Scan allows setup of the A-Scan configuration and scanning parameters for data acquisition. During data capture, live views for both A-Scan and B-Scan traces are shown along with the scan controls for the acquisition device.

Figure 4–5 Acquisition: B-Scan window

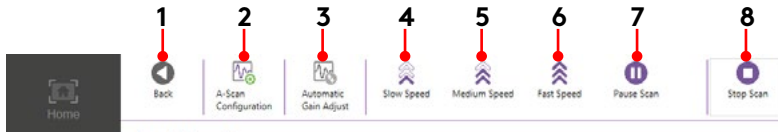


1. **Back**
Tap this button to return to the **Acquisition Device** window.
2. **A-Scan Configuration**
Tap this button to access the **A-Scan Configuration** window.
3. **Automatic Gain Adjust**
Tap this button to automatically adjust the gain of the A-Scan signal that breaks gate 2, or gate 1 when gate 2 is off, to 80% screen height, within a tolerance of +/-10%.
4. **Start Scan**
Tap this button to progress onto the start scan windows. Scan acquisition modes are selection of either Automatic or Manual mode.
5. **A-Scan view**
The A-Scan signal captured by the acquisition device is viewed along with gate positions. The horizontal axis is time base and the vertical axis is signal amplitude.
6. **B-Scan view**
This area displays the B-Scan inspection data captured by the acquisition device. The horizontal axis is distance and vertical axis is thickness.

Automatic Scan Toolbar

During an automatic scan with the Scorpion2 the toolbar menu displays the following options:

Figure 4–6 Automatic scan toolbar



1. **Back**
Not available.
2. **A-Scan Configuration**
Tap this button to access the **A-Scan Configuration** window.
3. **Automatic Gain Adjust**
Tap this button to automatically adjust the gain of the A-Scan signal that breaks gate 2, or gate 1 when gate 2 is off, to 80% screen height, within a tolerance of +/-10%.
4. **Slow Speed**
Tap this button to drive at a slow scanning speed.
5. **Medium Speed**
Tap this button to drive at a medium scanning speed.
6. **Fast Speed**
Tap this button to drive at a fast scanning speed.
7. **Pause Scan**
Tap this button to pause the scan.
8. **Stop Scan**
Tap this button to end the scan and progress to the data analysis and saving window.

Manual Scan Toolbar

During a manual scan with the Scorpion2 or R-Scan the toolbar menu displays the following options:

Figure 4–7 Manual scan toolbar

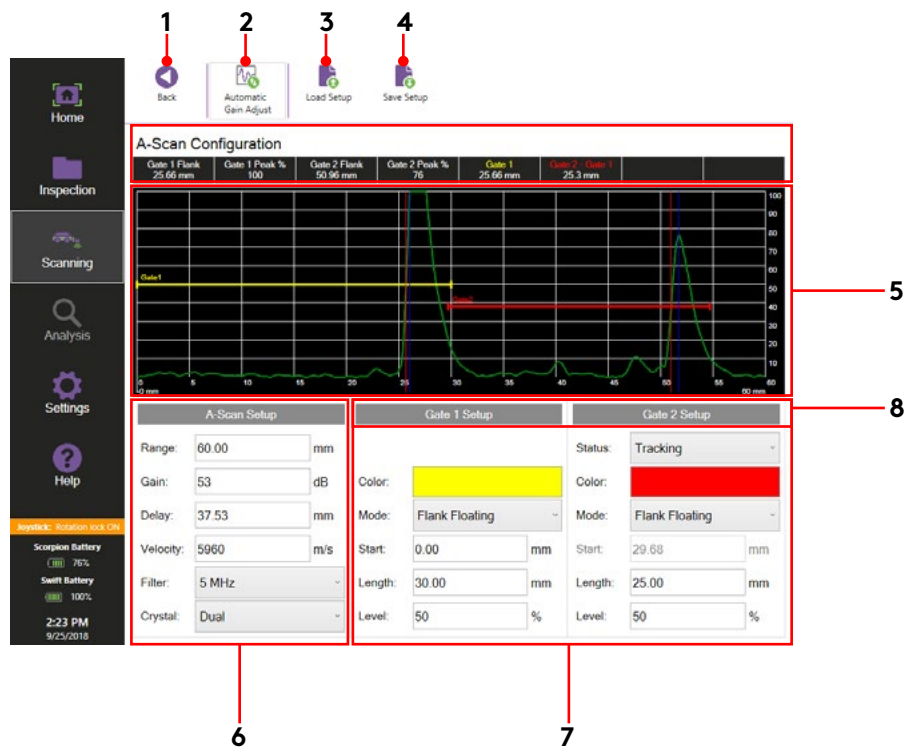


1. **Back**
Not available
2. **A-Scan Configuration**
Tap this button to access the **A-Scan Configuration** window.
3. **Automatic Gain Adjust**
Tap this button to automatically adjust the gain of the A-Scan signal that breaks gate 2, or gate 1 when gate 2 is off, to 80% screen height, within a tolerance of +/-10%.
4. **Stop Scan**
Tap this button to end the scan and progress to the data analysis and saving window.

A-Scan Configuration window

A-Scan configuration window provides access to the ultrasonic and gate setup.

Figure 4–8 A-Scan configuration window



1. **Back**
Tap this button to return to the previous window.
2. **Automatic Gain Adjust**
Tap this button to automatically adjust the gain of the A-Scan signal that breaks gate 2, or gate 1 when gate 2 is off, to 80% screen height, within a tolerance of +/-10%.
3. **Load Setup**
Tap this button to load a saved setup.
4. **Save Setup**
Tap this button to save the existing setup.
5. **Gate Information**
Information regarding the gate readings and thickness measurements.
6. **A-Scan Display**
The A-Scan signal captured by the acquisition device is viewed along with gate positions. The horizontal axis is time base and the vertical axis is signal amplitude.
7. **A-Scan Setup**
Here, the ultrasonic parameters can be set accordingly.

To adjust **Range**, **Gain**, **Delay** or **Velocity** tap the desired option and enter a value using the number pad or use the directional arrows on Swift by altering the step/pre-set settings, then adjusting accordingly.

Set **Filter** to match the frequency of the transducer fitted to the acquisition device.

Set **Crystal** to match the transducer fitted to the acquisition device.

8. Gate Setup

Two gates are available in Swift software and are used to display thickness measurements.

Gate 1 is always active by default. To activate Gate 2 set the **Status** to either **Fixed** or **Tracking**. **OFF** disables Gate 2. **Fixed** positions Gate 2 onscreen at the desired **Start** position. **Tracking** allows Gate 2 to follow the flank position of the A-Scan signal that breaks Gate 1. This is achieved by maintaining a fixed distance between the position of Gate 1 flank and the start of Gate 2. So as the Gate 1 flank position changes the start position of Gate 2 automatically adjust to maintain that fixed distance. In order to set the **Start** position for Gate 2 change the gate status to **Fixed**. Once set, change the status back to **Tracking**.

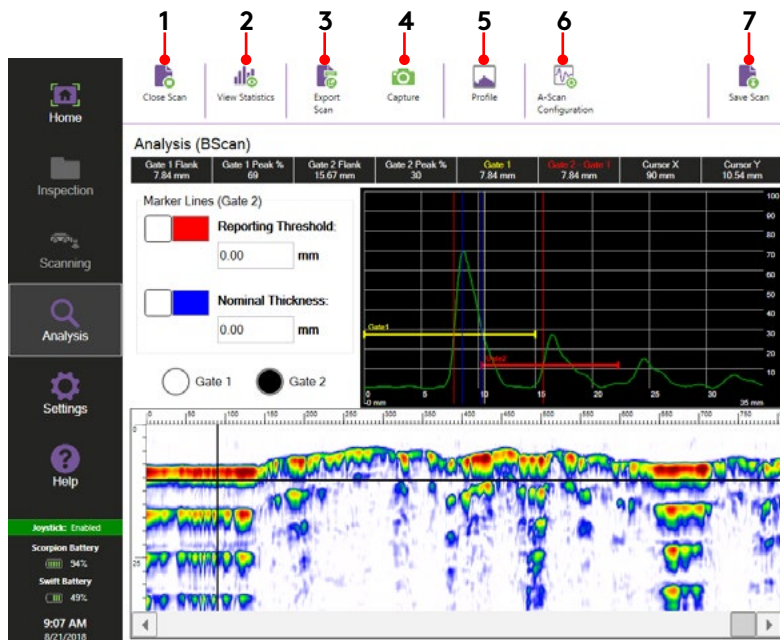
Gates are identified by their color. To change a gate color, tap the **Color** box relating to that gate then select a color. The **Mode** option sets the gate trigger to be either **Flank** (left edge) of the first signal to break the gate after the start position, **Flank Floating** so that it tracks vertically with the amplitude of the first signal to break the gate, or **Peak** so that it measurement the highest peak signal to break the gate.

To set the **Start**, **Length** and **Level** of a gate tap the desired option and enter a value using the number pad or use the directional arrows on Swift by altering the step/pre-set settings then adjusting accordingly. **Start** alters the start position of the gate relative to the screen. **Length** sets the width of the gate and **Level** sets the trigger threshold of the gate. For Peak and Flank gates, this level corresponds to the vertical height on the A-Scan trace. For Flank Floating gates the level corresponds to the amplitude of the tracked signal.

Analysis B-Scan window

Analysis B-Scan contains various tools for conducting data analysis of a saved scan.

Figure 4–9 Analysis B-Scan window



1. Close Scan

Tap this to close the scan and exit the Analysis window.

2. View Statistics / View Marker Lines

Tap this button to switch between the statistical information and view marker line tool for the desired gate.

3. Export Scan

Tap this button to access the **Export Scan** window. Here thickness measurement data of a scan can be exported onto a USB drive in either a CSV file format or a Microsoft Excel Workbook file format.

4. Capture

Tap this button to access the **Capture Scan** window where the current A-Scan and B-Scan views can be exported as image files to a USB drive.

5. Profile / Amplitude

Tap this button to switch the B-Scan view between the amplitude and profile views. The profile view is based on the selected gate option.

6. A-Scan Configuration

Tap this button to access the **A-Scan Configuration** window.

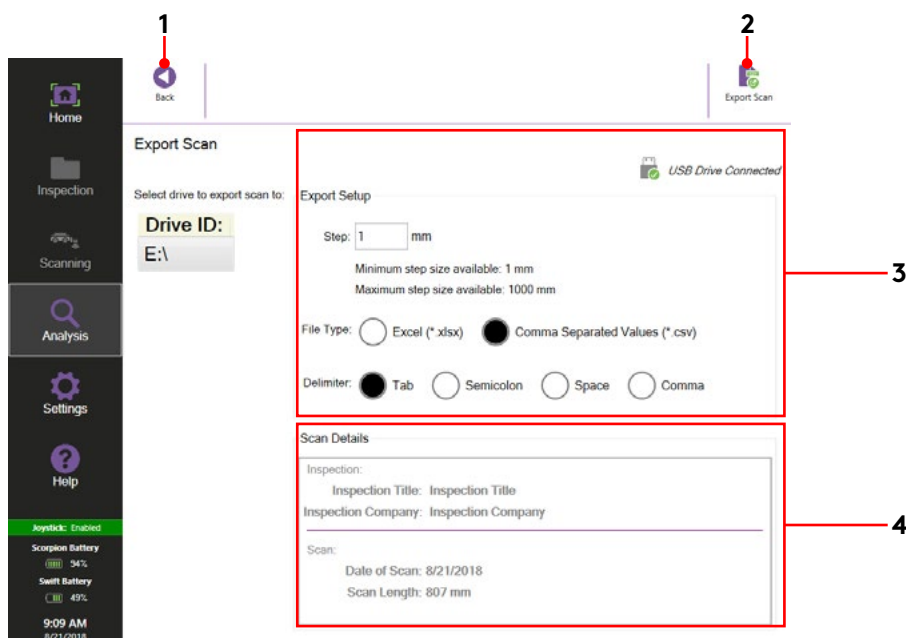
7. Save Scan

Tap this button to access the **Save Scan** window.

Export Scan window

Export Scan allows the current scan to be exported onto a USB drive as either a CSV file or a Microsoft Excel Workbook file format to a USB drive. Before the scan can be exported, a USB drive must be connected to Swift.

Figure 4-10 Export scan window



1. Back

Tap this button to return to the previous window.

2. Export Scan

Tap this to export the scan onto a USB drive.

3. Export Setup

Set the require step for data export and select the file type for the data export.

4. Scan Details

Displays information relating to the specific scan.

Capture Scan Image window

Capture Scan allows an image of either an A-Scan or B-Scan to be saved onto a USB drive.

Figure 4-11 Capture scan window

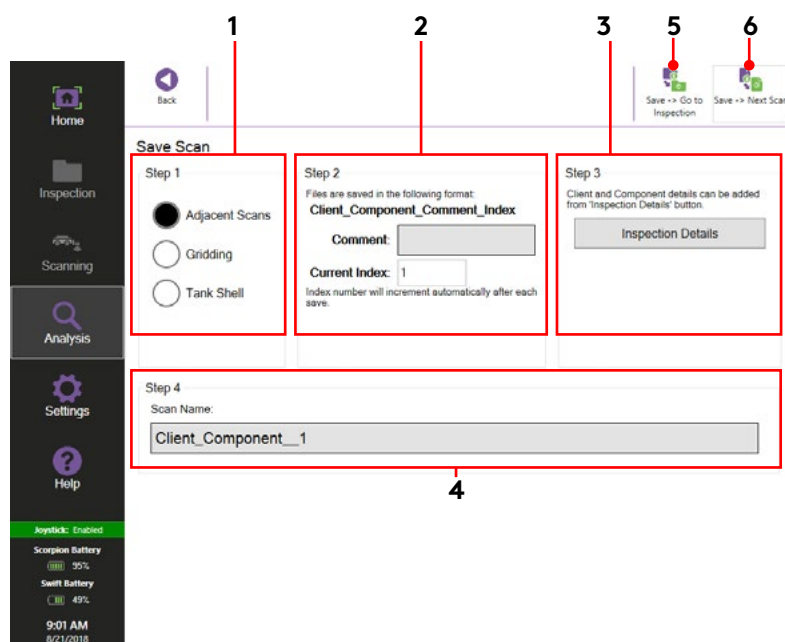


1. **Back**
Tap this button to return to the previous window.
2. **A-Scan**
Tap this to select the A-Scan image at the cross hair position. A preview of the image is displayed.
3. **B-Scan**
Tap this to select the B-Scan image. A preview of the image is displayed.
4. **Save**
Tap this to save the image onto a USB drive.

Save Scan

The Save Scan window allows a scan to be saved as either adjacent scan, gridding or tank shell format, and is split into 4 steps. Adjacent Scans saves scans in a sequential number, Gridding saves scans in a row and column format with a separation value and Tank Shell option saves scans in scan, scan separator and course format. The file name and numbering is created automatically using the entered inspection details and the numbering from the inspection mode details. Scan numbering increases sequentially.

Figure 4–12 Save scan window



1. **Step 1**
Tap the required save mode for the inspection.
2. **Step 2**
The save options change depending upon which option is selected in Step 1.
3. **Step 3**
Tap here to open the **Inspection Details** window. Changing the **Client** or **Component** field changes the name of the scan file.
4. **Step 4**
Displays the scan name of the scan to be saved. If required, tap in the box to change the file name.

Note: To overwrite an existing scan use the keyboard and change the scan name to the scan that has already been saved.
5. **Save -> Go to Inspection**
Tap this button to save the current scan and return to the **Inspection Details** window.
6. **Save->Next Scan**
Tap this button to save the current scan and return to the **Acquisition B-Scan** window.

Adjacent Scans

This option saves scans using a number index which increases sequentially after each saved scan. The file name appears in the format: client_component_comment_index

Figure 4-13 Adjacent scan save options

The screenshot shows the 'Save Scan' dialog with four steps. Step 1 has three radio buttons: 'Adjacent Scans' (selected and highlighted with a red box), 'Gridding', and 'Tank Shell'. Step 2 shows the file format 'Client_Component_Comment_Index'. It has a 'Comment' field (labeled 1) and a 'Current Index' field with the value '1' (labeled 2). Below the index field, it says 'Index number will increment automatically after each save.' Step 3 has an 'Inspection Details' button. Step 4 has a 'Scan Name' field with the value 'Client_Component__1'.

1. **Comment**
Tap here to add a comment which appears as part of the file name.
2. **Current Index**
This is the number the scan is saved as.

Gridding

This option saves the scans in a row or column format with a separation value. After each saved scan, the rows, or columns, value increases sequentially.

Figure 4-14 Gridding scan save options

The screenshot shows the 'Save Scan' dialog with four steps. Step 1 has three radio buttons: 'Adjacent Scans', 'Gridding' (selected and highlighted with a red box), and 'Tank Shell'. Step 2 shows the file format 'Files are saved and identified as a Row or Column with separation value.' It has two radio buttons: 'Row' (selected) and 'Column'. Below them is a 'Row' field with the value '1' (labeled 2) and a 'Row separation' field with the value '1000.00 mm' (labeled 3). Step 3 has an 'Inspection Details' button. Step 4 has a 'Scan Name' field with the value 'Client_Component'. Below the scan name field is a grid diagram with 5 columns (labeled Col 1 to Col 5) and 5 rows (labeled Row 1 to Row 5). A red arrow labeled 'Row Separation' points to the gap between Row 1 and Row 2.

1. **Scan Save Format**
Select either **Row** or **Column** option
2. **Row / Column Number**
This is the row or column number the scan is saved as.
3. **Row / Column Separator**
This is the distance between each row or column.

Tank Shell

This option saves scans in a scan and course format. After each saved scan, the course number increases sequentially.

Figure 4-15 Tank shell save options

The screenshot displays the 'Save Scan' workflow. In Step 1, 'Tank Shell' is the selected option. Step 2 shows the configuration for the first scan: Scan 1, with a separation of 1000.00 mm, and Course 1. Red annotations 1, 2, and 3 highlight the Scan, Separation, and Course fields. Step 3 includes an 'Inspection Details' button. Step 4 shows the 'Scan Name' as 'Client_Component'. A diagram at the bottom illustrates a tank shell with vertical scan lines labeled Scan 1 through Scan 6, and horizontal course lines labeled Course 1 through Course 4.

1. Scan

This refers to the scan number being conducted on the tank shell.

2. Separation

This is the distance between each scan.

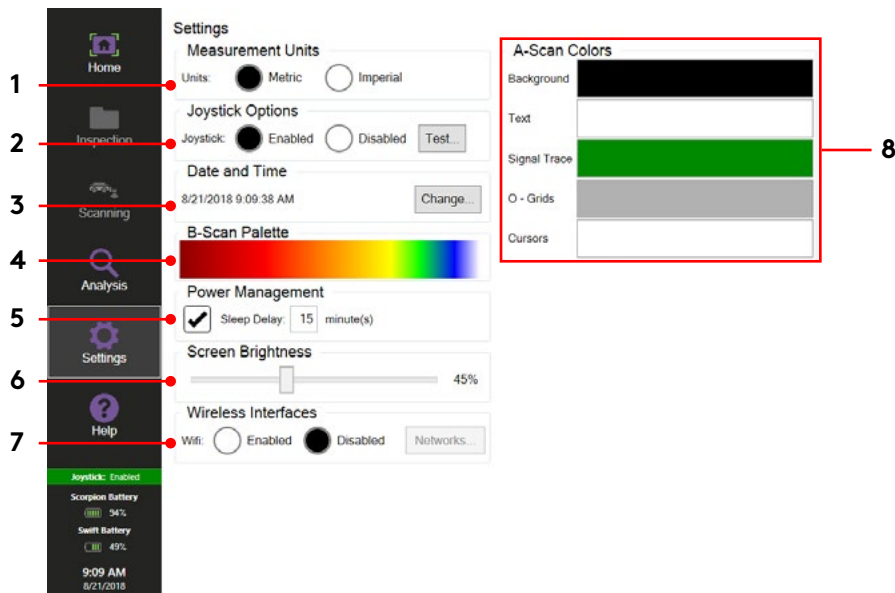
3. Course

This refers to the course number of the tank shell being scanned.

Settings

Settings contains the options for the inspection measurement units, color options relating to the A-Scan and B-Scan and configuration settings for Swift.

Figure 4-16 Settings view



1. Measurement Units

Sets the units of measurement for Swift to be either metric 'mm' or imperial 'inches'.

2. Joystick Options

Sets the functionality of the joystick on Swift.

3. Date and Time

Sets the date and time for Swift.

4. B-Scan Palette

Sets the amplitude B-Scan color palette view from pre-defined options.

5. Power Management

When active, a sleep timer delay of between 1 to 30 minutes can be configured. By default, the sleep time is 15 minutes.

Power Management turns off the display and the power LED goes from green to flashing orange.

Swift goes into sleep mode when the touchscreen and keypad buttons (except the power button) are idle for the Sleep Delay period.

To exit the sleep mode, quickly press the power button, touch the display, or press any of the other keypad buttons.

6. Screen Brightness

Set the screen brightness level of Swift.

7. Wireless Interface

Set the functionality of the Wi-Fi on Swift.

8. A-Scan Colors

Set the color for the various options in the A-Scan display.

Help

Help contains information regarding Swift instrument, the software version and license details. Here, it is possible to copy a log file to a USB device in case there is a problem with the system.

Figure 4–17 Help

The screenshot shows the 'Help' screen of the Swift instrument software. On the left is a vertical navigation bar with icons for Home, Inspection, Scanning, Analysis, Settings, and Help (selected). Below the navigation bar, a status bar shows 'Joystick: Enabled', 'Scorpion Battery' at 83%, 'Swift Battery' at 50%, and the time '9:40 AM' on '8/24/2018'.

The main content area is titled 'Help' and contains several sections:

- System**
 - Software Version: Swift 1.1B1
 - OS Package Version: 1.2R11
 - App Manager Version: 1.2R3
- Instrument**
 - Model: IU-UT
 - Serial Number: 1725715
 - Package Version: 1.0R3
 - Firmware Version: 1.0R1.15
- Scorpion**
 - MonoHost Version: 1.1B1
 - dsPIC Payload Version: 010d
- License**
 - Company: Eddyfi NDT
 - Licensee:
 - License Type: Subscription
 - Expiration: 1/31/2019
 - Host ID: C66B7A0C
- Third-Party Licenses**
 - Show Software Licenses
 - Show Instrument Licenses
- Contact Information**
 - Eddyfi (UK) Ltd
 - Clos Llyn Cwm
 - Swansea Enterprise Park
 - Swansea
 - SA6 8QY
 - Wales, UK
 - T +44 (0)1792 798711
 - http://www.silverwingndt.com
 - support-sw@eddyfi.com
 - Show License Agreement
- Log**
 - Copy log to USB
- Privacy Options**
 - ☒ Eddyfi Technologies Product Improvement Program
 - Show Program Details

Chapter 5

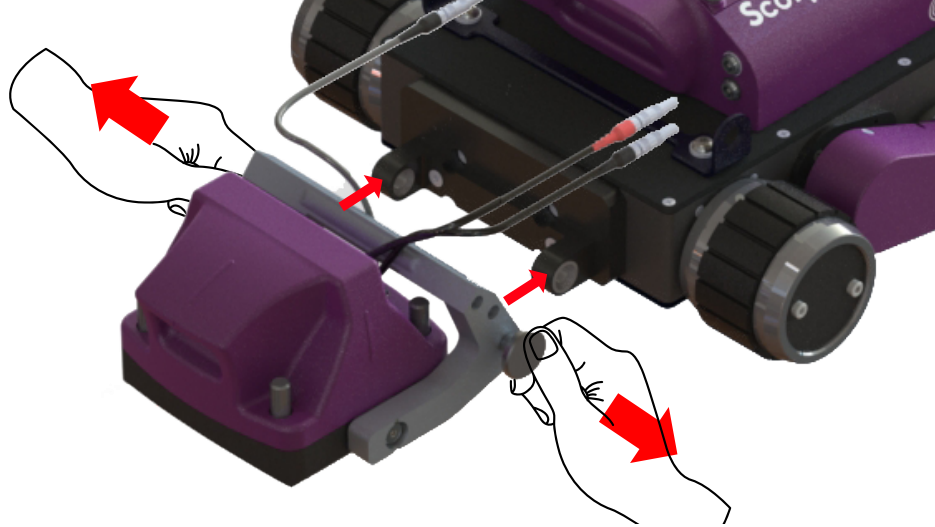
Inspection Preparation

Connecting Swift to Scorpion2

To connect the system together:

1. Remove Swift, umbilical cable, Scorpion2 and its probe head from their transit cases.
2. Attach the probe head to the front of the Scorpion2 using the plunger pins.

Figure 5-1 Scorpion2 probe head connection



3. Connect both ultrasonic wheel probe Lemo00 connectors to the front of Scorpion2 crawler. Ensure the color of the connector boot matches the color ring of the connector on the crawler.
4. Connect the probe head linear actuator Lemo0B connector to the front of Scorpion2 crawler. Ensure the red dot on the connector lines up with the red dot on the bulkhead socket.

Figure 5-2 Scorpion2 front connectors



5. Insert batteries into Swift and Scorpion2.
6. Apply silicone oil to the wheel probe and cleaning pad of Scorpion2.
7. Unwind both sides of the umbilical cable to the required length, as failure to do so could twist the cable.
8. Connect the umbilical Lemo2B connector to the rear of Scorpion2 crawler lid. Ensure the red dot on the connector lines up with the red dot on the bulkhead socket.
9. Connect both umbilical ultrasonic Lemo00 connectors to the rear of Scorpion2 crawler lid. Ensure the color of the connector boot matches the color ring of the connector on the crawler.
10. Attach both umbilical tether clips to the anchor points on the rear handle.

Figure 5–3 Scorpion2 rear connectors



11. Remove the umbilical connector protective cap and connect the umbilical Lemo2B connector to the I/O connector on Swift. Ensure the red dots are aligned.
12. Remove the umbilical connector protective cap and connect the ultrasonic Lemo00 connector with the red boot to the color coded TX/ RX connector on Swift.
13. Remove the umbilical connector protective cap and connect the ultrasonic Lemo00 connector with the black boot to the color coded TX connector on Swift.
14. Attach a suitable tether line to Scorpion2 crawler anchor points.
15. Power on Swift. Ensure the emergency stop button is reset by rotating clockwise. Check the LED on Scorpion2 lid to establish the connection status. The LED displays the following information:
 - Green: Power on and communication with Swift
 - Red Flashing: Power on but no communication with Swift
 - Blue: Scorpion2 firmware read/write status
 - Off: No Power to Scorpion2

NOTE

It can take up to 30 seconds for Scorpion2 to boot. Once a connection is established, the LED is lit Green and Swift software displays Scorpion2 battery status.

Scorpion2 Inspection Surface Preparation

The condition of the inspection surface is critical to the quality of the results obtained from the scanner.

The ferrous inspection surface to be inspected must:

- have a maximum ambient temperature of no greater than 40°C (104°F);
- have a minimum ambient temperature of no lower than 0°C (32°F);
- have a minimum diameter of 3.0 m (10 ft) for external longitudinal inspection;
- have a minimum diameter of 3.0m (10 ft) for external circumferential inspection;
- have a minimum diameter of 5.0m (17 ft) for internal longitudinal inspection;
- have a minimum diameter of 3.0m (10 ft) for internal circumferential inspection;
- be free of excess rust, scale, ferrous debris, oil, ice, frost or any organic growth;
- have a minimum nominal material thickness of 4.7mm (3/16 in) for magnetic adherence;
- have a maximum material thickness of no greater than 100mm (4 in);
- be coated to a thickness no greater than 1mm (3/64 in).

Inspecting on Slippery, Damp or Wet Surfaces

Slippery conditions will compromise the performance of the Scorpion2 crawler. If the inspection surface is slippery, then it is recommended to not drive the crawler or not to perform an inspection at its maximum speed of travel.

Scan Path

Visually check the scan path of the Scorpion2 crawler and identify if any obstructions exist. Driving over obstructions could cause the crawler to slip or be dislodged from the inspection surface.

Ensure there are no areas of non-ferrous material along the scan path. Driving across non-ferrous material results in a loss of magnetic attraction that could cause the crawler to slip or be dislodged from the inspection surface.

When operating Scorpion2 at height, cordon off an area in all directions directly below the intended scan path to ensure safe usage of the system as well as the operators and any by-standers.

WARNING!

Do not steer or turn the Scorpion2 when driving or inspecting across plate welds as it is possible to damage the encoder wheels.

WARNING!

Due to the high amount of current required by each motor it may not be possible to steer or rotate the Scorpion2 on its axis when on an uncoated plate. Continuous attempts to overcoming the high magnetic attraction can put unwanted mechanical stress on the system. Current limiting circuitry is designed to protect the electronics within the Scorpion2 crawler.

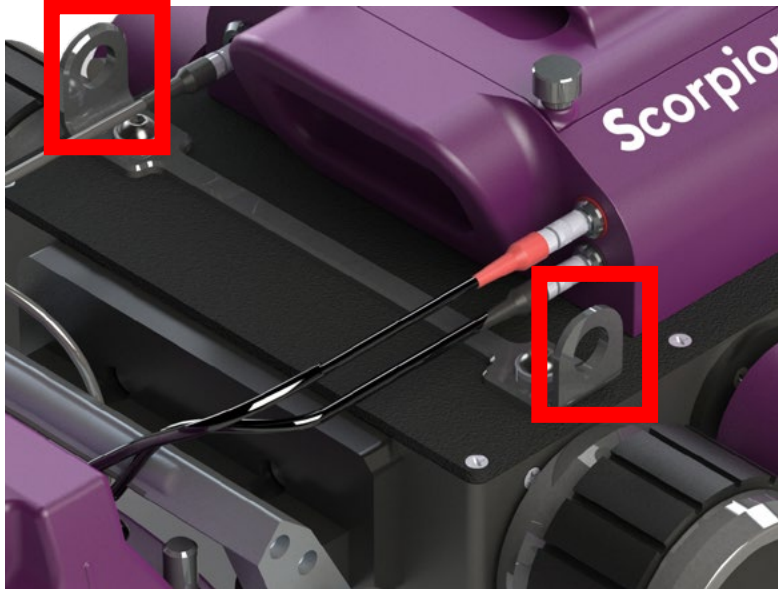


Scorpion2 Tether Line Attachment

CAUTION
DO NOT OPERATE
WITHOUT TETHER

Two tether line attachment points are located on Scorpion2 crawler. During operation, there must always be a tether line attached to Scorpion2 crawler with a proper tether system to prevent the crawler from falling.

Figure 5-4 Tether points



DANGER FALLING OBJECT HAZARD!

Keep the area below an operating crawler clear at all times. A NO ENTRY ZONE must be clearly marked and cordoned off all directions directly below the crawler.

Connecting Swift to R-Scan

To connect the system together:

1. Remove Swift, R-Scan and umbilical cable from their transit cases.
2. Insert batteries into Swift.
3. Apply silicone oil to the wheel probe and cleaning pad of R-Scan.
4. Connect the umbilical Lemo connector to the rear of R-Scan. Ensure the red dot on the connector lines up with the red dot on the bulkhead socket.

Figure 5-5 R-Scan rear connector and Swift connection



5. Connect the umbilical Lemo2B connector to the I/O connector on Swift. Ensure the red dots are aligned.
6. Connect the ultrasonic Lemo00 connector with the red boot to the color coded TX/RX connector on Swift.
7. Connect the ultrasonic Lemo00 connector with the black boot to the color coded TX connector on Swift.
8. Power on Swift. Ensure the emergency stop button is reset by rotating clockwise.

R-Scan Inspection Surface Preparation

The condition of the inspection surface is critical to the quality of the results obtained from the scanner.

The ferrous inspection surface to be inspected must:

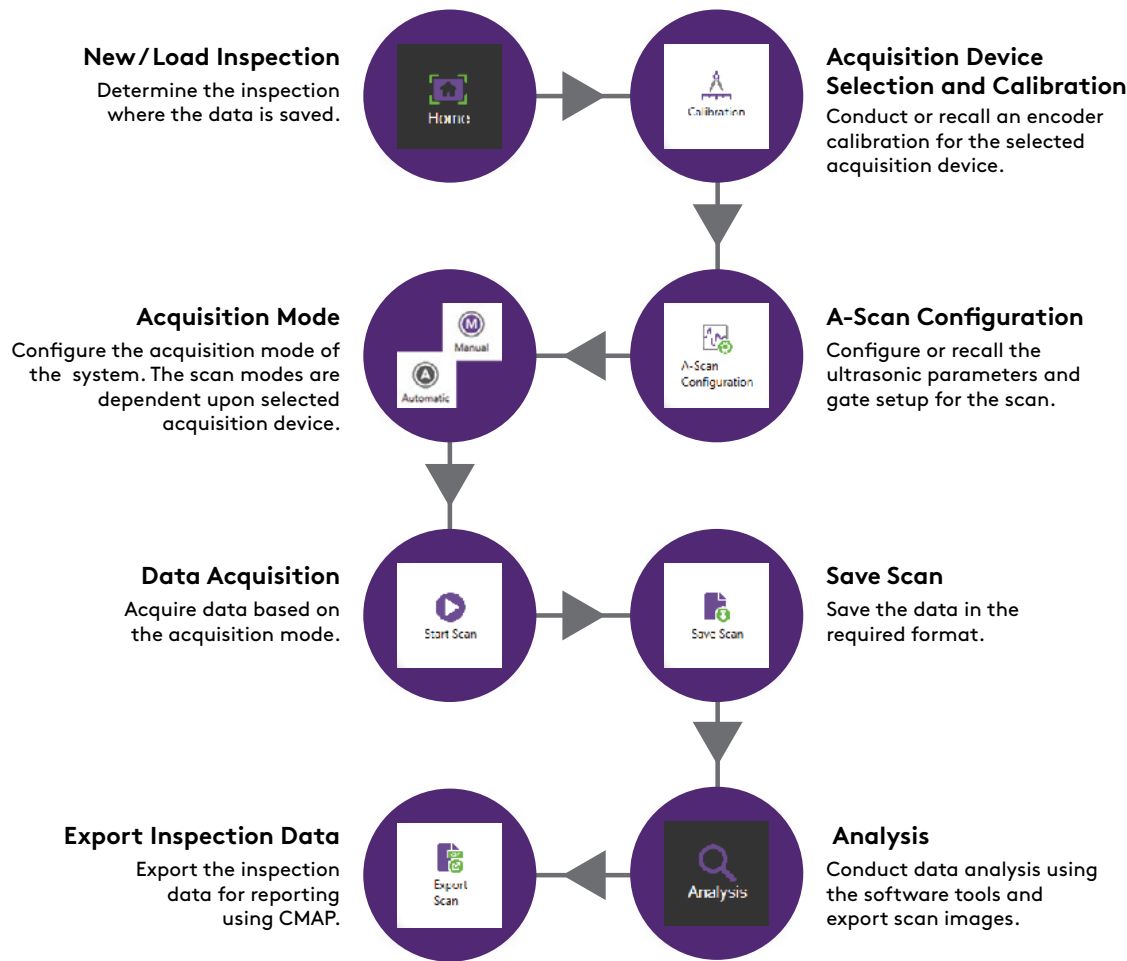
- have a surface temperature of no greater than 80°C (176°F);
- have a surface temperature of no lower than 0°C (32°F);
- have a minimum diameter of 50 mm (2 inch);
- be free of excess rust, scale, ferrous debris, oil, ice, frost or any organic growth;
- have a minimum nominal material thickness of 2.5 mm (0.1 in);
- have a maximum material thickness of no greater than 100 mm (4 in);
- be coated to a thickness no greater than 1 mm (3/64 in).

Chapter 6

Workflow

Typical Inspection Workflow

Figure 6-1 Typical inspection workflow



New / Load Inspection

New Inspection:

1. Tap **New Inspection** in the **home** window to load the **Inspection Details** window.

Figure 6–2 Inspection details window

2. Enter the required information for the inspection.
3. Tap **Save Details and Begin Scan** to continue.

Load Inspection

To load an existing inspection:

1. Tap **Load Inspection** in the **Home** window to load the **Select Inspection** window.

Figure 6–3 Select inspection window

Inspection Date	Inspection Title	Scans
8/21/2018	Inspection Title	3

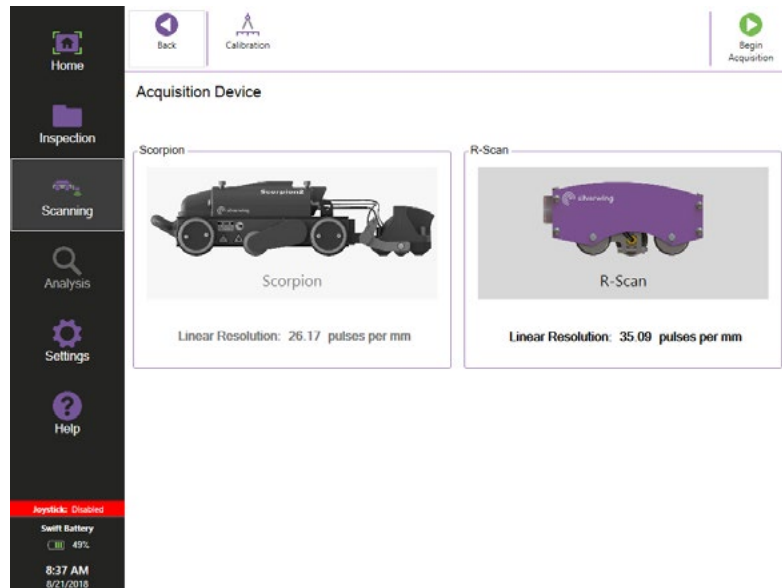
2. Select the required inspection from the list of existing inspections saved on Swift.
3. Tap **Load Inspection**.
4. In the **Inspection Details** window check the inspection details and edit if required.
5. Tap **Save Details and Begin Scan** to continue.

Acquisition Device Calibration

The Swift automatically selects which of the available acquisition devices is connected. Scorpion2 is selected only when there is an active connection established to the crawler. R-Scan is selected if there is no connection established to the Scorpion, if there is a loss with the connection, or if the acquisition device has changed to the R-Scan head.

The correct linear resolution must be used when inspecting with Scorpion2 or R-Scan. Either perform a new encoder calibration or load an encoder calibration, if one already exists.

Figure 6–4 Acquisition device window



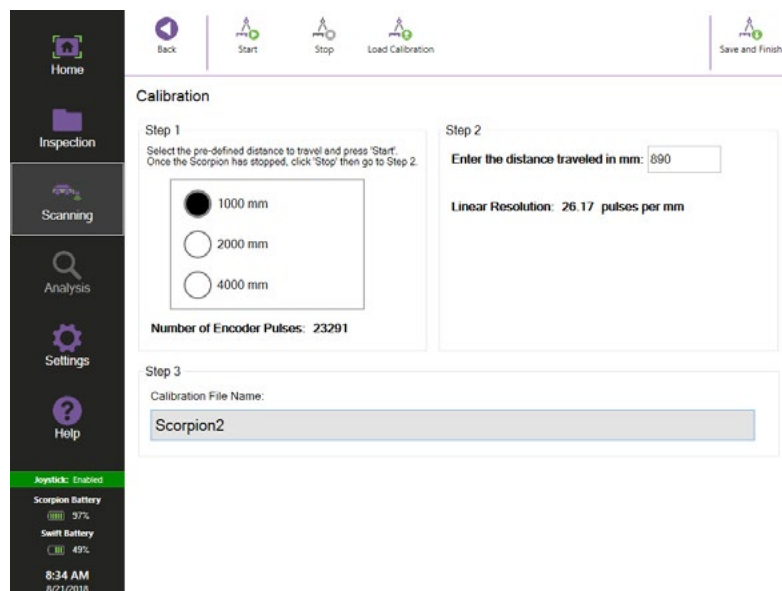
Scorpion2 Encoder Calibration

To perform a new encoder calibration:

1. Tap **Calibration** in the **Acquisition Device** window to load the **Calibration** window.
2. Place Scorpion2 crawler onto a ferrous surface, then mark a datum point on the inspection surface.

Note: A marker line on the probe head cover shows the wheel probe position.

Figure 6–5 Calibration window for Scorpion2



3. In **Step 1**, select a pre-defined distance for Scorpion2 to travel then tap **Start**.
Note: this drives the crawler forwards.
4. Tap **Stop** once the crawler has halted.
5. Measure the distance travelled by the scanner.
6. In **Step 2**, enter the distance travelled then tap the enter button. A Linear resolution value for the Scorpion2 is displayed and is typically around 26 pulses per mm
7. In **Step 3**, enter a calibration file name then tap **Save and Finish**. This saves the calibration file and returns to the Acquisition Device window.
8. Tap **Begin Acquisition** to continue.

R-Scan encoder calibration

To perform a new R-Scan encoder calibration:

1. Tap **Calibration** in the **Acquisition Device** window to load the **Calibration** window.

Figure 6-6 Calibration window for R-Scan

The screenshot shows the 'Calibration' window for R-Scan. The interface includes a sidebar with navigation options: Home, Inspection, Scanning, Analysis, Settings, and Help. The main content area is divided into three steps. Step 1 displays 'Number of Encoder Pulses: 10528'. Step 2 shows 'Enter the distance traveled in mm: 300' and 'Linear Resolution: 35.09 pulses per mm'. Step 3 shows 'Calibration File Name: R-Scan'. At the top right, there are buttons for 'Back', 'Start', 'Stop', 'Load Calibration', and 'Save and Finish'. The bottom status bar indicates 'Jysticks: Disabled', 'Swift Battery 49%', and the time '8:37 AM 6/21/2018'.

2. Place R-Scan head onto a ferrous surface, then mark a datum point on the inspection surface.
3. In **Step 1**, tap **Start**. Move the scanner forward a minimum of 250mm.
4. Tap **Stop** then mark a second reference point in relation to the fixed point on the scanner
5. Measure the distance travelled by the scanner.
6. In **Step 2**, enter the distance travelled then tap the enter button. A Linear resolution value for the R-Scan is displayed and is typically around 35 pulses per mm.
7. In **Step 3**, enter a calibration file name then tap **Save and Finish**. This saves the calibration file and returns to the Acquisition Device window.
8. Tap **Begin Acquisition** to continue.

Load Encoder Calibration

To load an existing encoder calibration:

1. Tap **Calibration** in the **Acquisition Device** window to load the **Calibration** window.
2. Tap **Load Calibration**.
3. Select the required encoder calibration file name and tap **Load**.
4. Tap **Save and Finish** to return to the **Acquisition Device** window.
Note: If back is selected, the calibration is not loaded.
5. Tap **Begin Acquisition** to continue.

A-Scan Configuration

Capturing accurate and reliable thickness gauge data requires:

1. Correct transducer selection. Scorpion2 and R-Scan are fitted with a 5MHz twin crystal transducer.
2. An accurate reference block of the same material as that being tested. The calibration or reference block should be made of material with the same sound velocity and attenuation characteristics as the material to be inspected. It should have parallel machined surfaces representing the thickness range to be inspected. A minimum of two thicknesses representing the minimum and maximum values is acceptable for calibration, however it is recommended that the calibration block has four different thickness sections to cover the expected thickness range to allow for verification of the calibration.
3. Correct ultrasonic calibration on Swift. The aim of the calibration is to set the ultrasonic parameters to clearly view the echoes and position the gates to read the correct material thickness.

A-Scan Calibration

It is possible to calibrate using only one known material thickness. However it is recommended to verify the calibration across a range of known thicknesses.

To conduct a manual A-Scan calibration:

1. Place the transducer onto the calibration block.
2. Tap **A-Scan Configuration** to access the A-Scan Configuration window.

Figure 6–7 A-Scan configuration



3. Set **Crystal** so that it matches the transducer connected to Swift.
4. Set **Filter** so that it matches the transducer connected to Swift.
5. Set **Velocity** to the material velocity under test.

Note: The velocity for mild steel is 5960 m/s [0.234 in/us].

6. Adjust **Range** and **Delay** so the echoes from the desired thickness range can be viewed. It is recommended to view no more than three back wall echoes and that the first back wall echo is positioned along the time base value that corresponds to the material thickness.

Note: Due to the thickness of the wheel probe tires, delay is typically around 35mm (1.3 in)

7. Adjust the gain so that the second echo is at about 80% full screen height.
8. Set the **Mode** of Gate 1 to the desired gate trigger. It is recommended to set to **Flank Floating**.

9. Position Gate 1 across the first back wall echo so that it covers the thickness range of interest. Adjust the level of the gates to around 50% of echo height.
 10. Activate Gate2 by setting **Status** to either Fixed or Tracking.
 11. Set the **Mode** of Gate 2 to the same as Gate 1.
 12. Position Gate 2 across the second back wall echo so that it covers the thickness range of interest. Adjust the level of the gates to around 50% of echo height.
- Note: To alter the start position of a tracking gate it must be changed to a fixed gate. Once the start position has been set it can be changed back to a tracking gate.
- Note: If Gate2-Gate1 thickness value does not match the true thickness of the calibration block used then adjust Velocity until the true thickness is displayed.
13. Adjust **Delay** so that the thickness value of Gate 1 is identical to Gate 2 thickness value.

Save Setup

To save the A-Scan setting file:

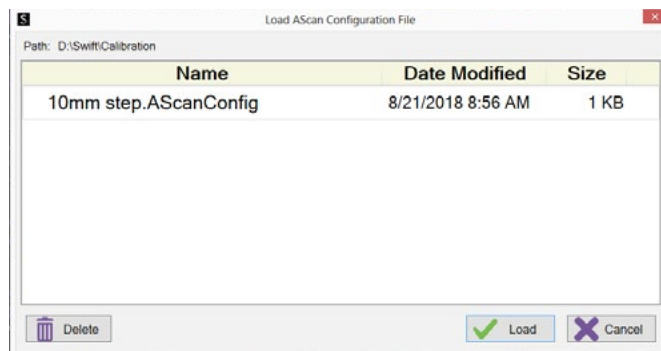
1. Tap **Save Setup** in the A-Scan Configuration window.
2. Enter a suitable file name then tap **Save**.
3. Tap **Back** to return to the Acquisition: B-Scan window.

Load Setup

To load a pre-saved A-Scan setting file:

1. Tap **Load Setup** in the A-Scan Configuration window.

Figure 6–8 Load A-Scan configuration window



2. Select the required setup file then tap **Load**.
3. Tap **Back** to return to the Acquisition: B-Scan window.

Acquisition Mode

The available acquisition modes are dependent upon the acquisition device detected by the Swift.

Scorpion2

A suitable acquisition mode must be selected in order for Scorpion2 to perform a scan. The available modes are:

- **Automatic mode**

Scorpion2 drives automatically and relies on both encoders to actively steer during the scan to ensure it travels in a straight line.

Note: Surface condition and scan direction can affect steering accuracy.

When conducting an automatic scan, details of a scan offset, scan length, scan direction and scan speed must be entered prior to a scan.

- **Manual mode**

Scorpion2 is driven by either using Swift joystick or by holding the nudge forward and backward button on Swift, and relies on the right hand encoder to record the distance travelled. When conducting a manual scan, details of a scan offset must be entered prior to a scan.

The maximum distance the crawler can travel in one scan is 50m (164 ft).

If the battery level of Scorpion2 is 15% or below the crawler is prevented from performing an inspection. When attempting to inspect, a warning message is displayed. Scorpion2 can still be driven using the joystick, but in order to continue the inspection, the battery in Scorpion2 must be changed.



CAUTION!

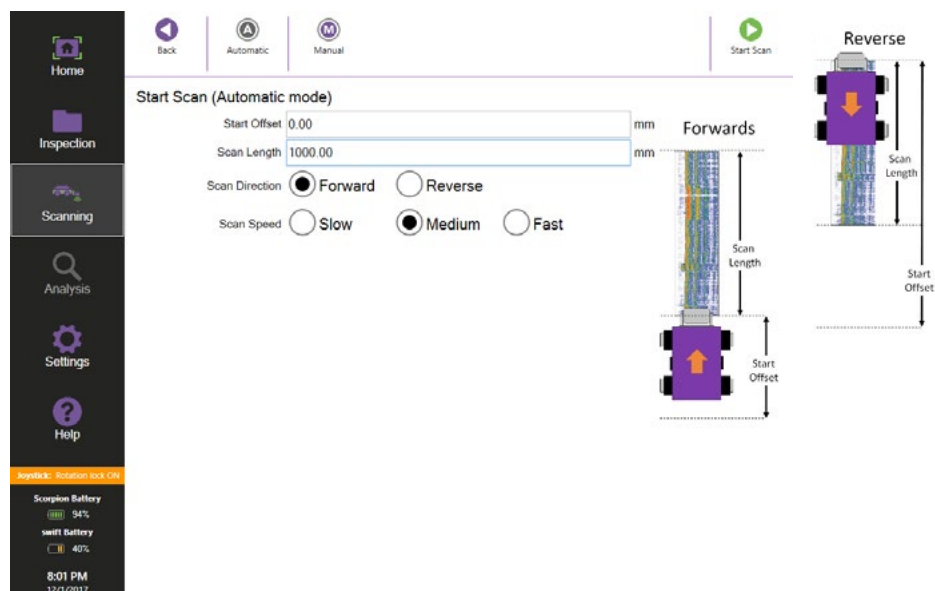
If the battery level of Scorpion2 or Swift is 15% or below, the system prevents any scanning. To continue, change the battery in Scorpion2 or Swift.

Automatic Mode

To begin an automatic scan:

1. Tap **Start Scan** in the Acquisition: B-Scan window.
2. Tap **Automatic** to view the Start Scan (Automatic mode) window.

Figure 6–9 Start scan automatic window



3. Select the desired **Scan Direction**. Either **Forward** or **Reverse**.
4. Enter a **Start Offset** using the keypad. The start offset is a measurement from an inspection reference location to the actual position of the wheel probe.
5. Enter a **Scan Length** using the keypad.
6. Select a **Scan Speed**.
7. Click **Start Scan** to begin the acquisition.

During the acquisition Scorpion2 automatically drives the desired scan length then stops. The speed of the crawler can be altered by selecting the relevant speed option.

Tap **Pause** to halt the automatic drive of Scorpion2. A paused message appears on the scan. When paused, Scorpion2 can be manually driven using the joystick or by holding the nudge forward and backward button on Swift.

Tap **A-Scan Configurations** to alter the ultrasonic setup or gate parameters once the automatic scan has been paused.

Tap **Automatic Gain Adjust** to adjust the gain so that it sets the A-Scan signal that breaks gate 2, or gate 1 when gate 2 is off, to 80% screen height, within a tolerance of +/-10%, once the automatic scan has been paused.

Tap **Resume Scan** to continue the automatic drive of Scorpion2.

If the **Stop Movement** button on Swift is pressed the crawler halts and the data acquisition finishes.

8. Tap **Stop Scan** when the data acquisition is complete and progress onto the **Analysis** window.
9. Tap **Save Scan** in the Analysis Window.
10. In the Save Scan window select the desired mode for saving the data.
11. To progress to the next scan tap **Save->Next Scan**. Position the crawler as required and repeat steps 1 through 10.

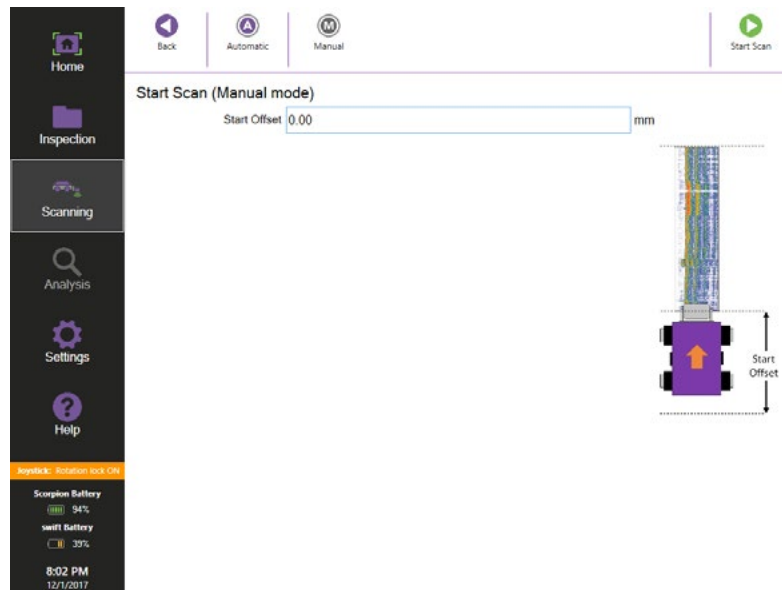
Note: To overwrite an existing scan use the keyboard and change the scan name to the scan that has already been saved.

Manual Mode

To begin a manual scan:

1. Tap **Start Scan** in the Acquisition: B-Scan window.
2. Tap **Manual** to view the Start Scan (Manual mode) window.

Figure 6–10 Start Scan (manual mode) window



3. Enter a **Start Offset** using the keypad. The start offset is a measurement from an inspection reference location to the actual position of the wheel probe.
4. Click **Start Scan** to begin the acquisition.
Drive Scorpion2 manually by either using Swift joystick or by holding the nudge forward and backward button on Swift.

To alter the ultrasonic setup or gate parameters during a manual scan, tap **A-Scan Configuration**. To automatically adjust the gain to set the A-Scan signal that breaks gate 2, or gate 1 when gate 2 is off, to 80% screen height, within a tolerance of +/-10%, tap **Automatic Gain Adjust**.

5. Tap **Stop Scan** when the data acquisition is complete and progress onto the **Analysis B-Scan Window**.
6. Tap **Save Scan** in the **Analysis B-Scan Window**.
7. In the **Save Scan** window select the desired mode of saving the data as either Adjacent Scans, Gridding or Tank shell.
Note: To overwrite an existing scan use the keyboard and change the scan name to the scan that has already been saved.
8. To progress to the next scan tap **Save->Next Scan**. Position the crawler as required and repeat steps 1 through 7.

R-Scan

The only available acquisition mode for the R-Scan is manual mode.

The maximum distance for a scan is 50m (164 ft).



CAUTION!

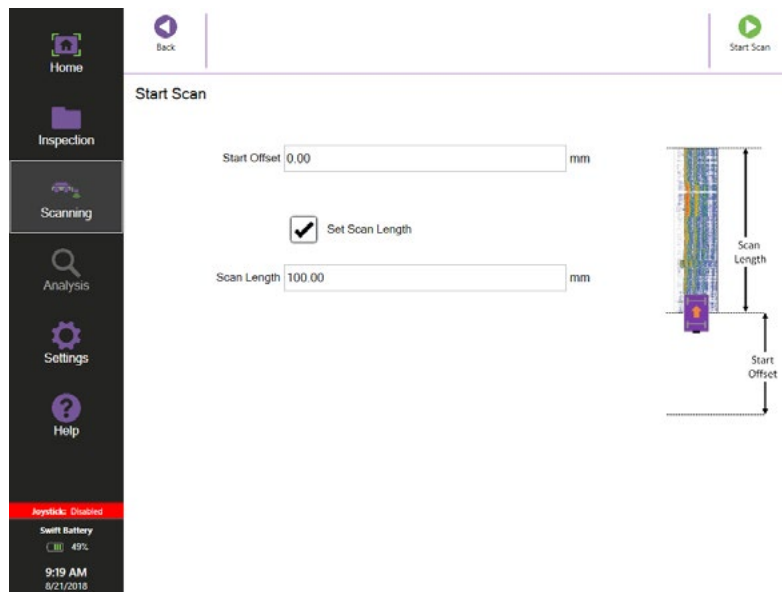
When the Swift battery level drops to 15% or below, the software prevents any scanning. To continue, change the battery in Swift.

Manual Mode

To begin a manual scan:

1. Tap **Start Scan** in the Acquisition: B-Scan window

Figure 6-11 Start Scan (manual mode) window



2. Enter a **Start Offset** using the keypad. The start offset is a measurement from an inspection reference location to the actual position of the wheel probe.
3. A **Scan Length** distance can be if required. Tick **Set Scan Length** then enter using the keypad.
4. Click **Start Scan** to begin the acquisition.

Manually scan by pushing the R-Scan scanning head forward.

If a scan length value has been set the data capture does not progress beyond it.

To alter the ultrasonic setup or gate parameters during a manual scan, tap **A-Scan Configuration**. To automatically adjust the gain to set the A-Scan signal that breaks gate 2, or gate 1 when gate 2 is off, to 80% screen height, within a tolerance of +/-10%, tap **Automatic Gain Adjust**.

5. Tap **Stop Scan** when the data acquisition is complete and progress onto the **Analysis B-Scan Window**.
6. Tap **Save Scan** in the **Analysis B-Scan Window**.
7. In the **Save Scan** window select the desired mode of saving the data as either Adjacent Scans, Gridding or Tank shell.

Note: To overwrite an existing scan use the keyboard and change the scan name to the scan that has already been saved.

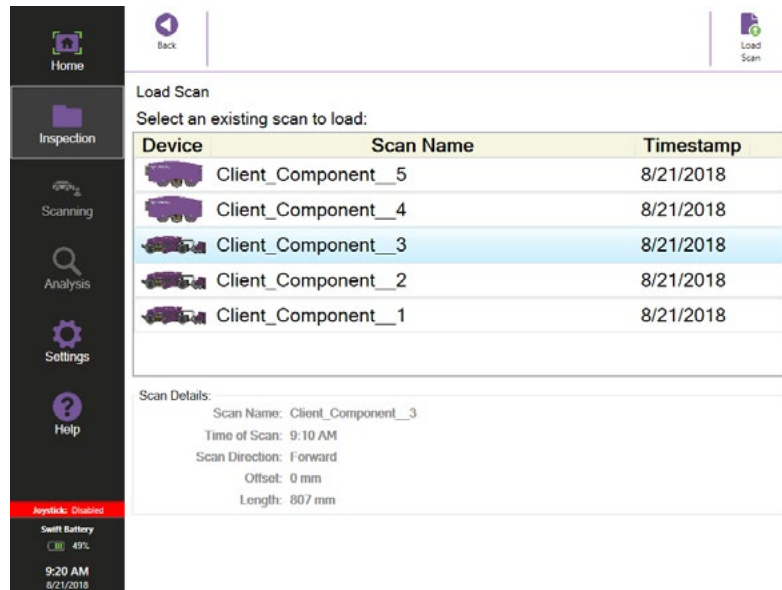
8. To progress to the next scan tap **Save->Next Scan**. Once the saving process has finished then re-position the crawler as required and repeat steps 1 through 7.

Analysis

Loading a Saved Scan

To load a scan for analysis:

Figure 6-12 Load scan window



1. Tap **Inspection** on the sidebar.
2. Tap **Load Scan**.
3. Select the required scan from the list then tap **Load Scan**.

B-Scan Viewing Options

The view of the B-Scan is set to zoom to fit the scan into the window. Use the zoom buttons on Swift to adjust the view and scroll use the scroll bar below the B-Scan.

Figure 6-13 Analysis (B-Scan) window



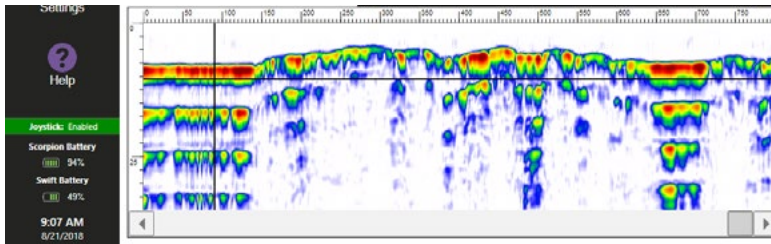
Tap on the B-Scan view to display the corresponding A-Scan signal at the cross hair location. Use the directional arrows on Swift to allow for on screen cursor adjustment.

The B-Scan data can be displayed as either an Amplitude or Profile view.

Amplitude View

This displays a multi-colored B-Scan view based on the amplitude of the A-Scan signal. The color palette for the amplitude view can be changed in the Settings sidebar menu.

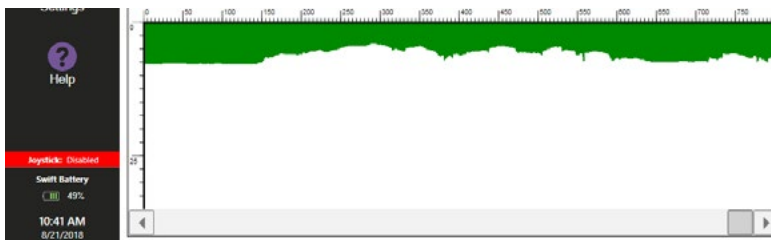
Figure 6-14 Amplitude view



Profile View

This displays the B-Scan view as a cross section based on material thickness values identified by the selected gate.

Figure 6-15 Profile view



CAUTION!



When no back wall echoes break the selected gate, or if there is a loss of back wall echo due to surface irregularities or the presence of corrosion, then the profile views show 0 thickness since no readings are recorded by the gate.

A-Scan Gate Adjustment

Gate positions can be altered after the scan if required. Any changes made will alter the thickness values recorded and the B-Scan profile view.

To access the gate setup menu:

1. Tap **A-Scan Configurations**.
2. Adjust the gate properties as required.

CAUTION!

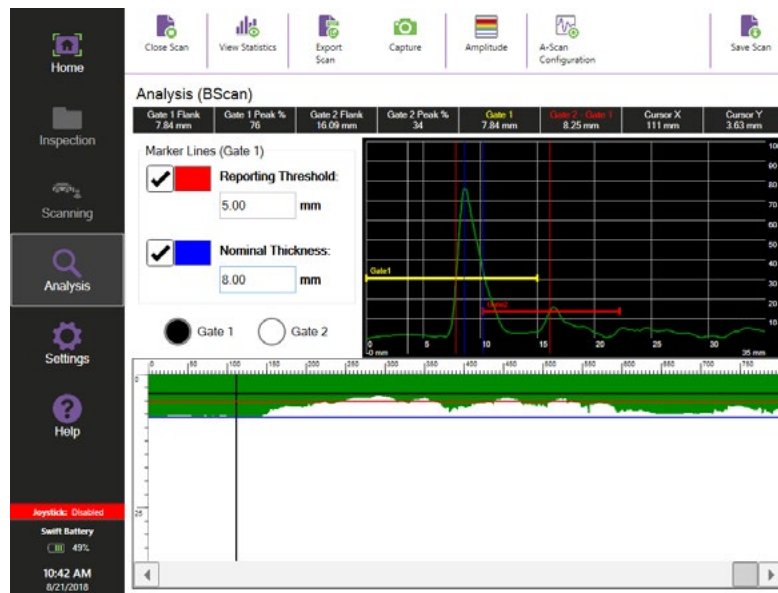


Any adjustment to the measurement gate position after a scan alters the thickness value and profile views. The statistics values displayed for that gate are also altered.

View Marker Lines

A horizontal line can be displayed on the B-Scan to indicate a reporting threshold and a nominal thickness. To display:

Figure 6-16 B-Scan analysis marker lines



1. Tap View **Marker Lines**.
2. Select the required Gate option and Tap **Profile** view.
3. Tick the required line option then enter the thickness value into the text box using the keypad. Tap the color box to change the line color.

View Statistics

Statistical information relating to the mean, maximum and minimum thickness of the selected gate can be shown along with their location on the scan. To display this information:

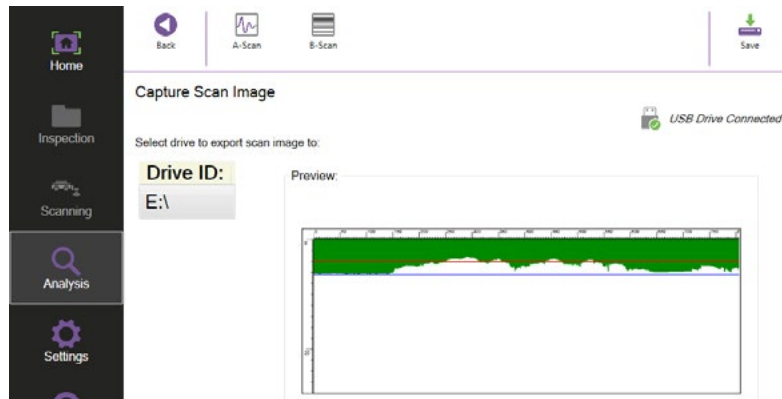
1. Tap **View Statistics**.
2. Select the required Gate option.
3. Tick to display the location of the minimum and maximum thicknesses found on the scan. Tap the color box to change the line color.

Export B-Scan Images to USB

Images of the B-Scan can be exported from Swift software onto a USB device.

To export the B-Scan image displayed in the B-Scan window:

Figure 6-17 Capture B-Scan image



1. Adjust the B-Scan view to suit.
2. Tap **Capture**.
3. Insert a USB device, ensure **USB Drive connected** is displayed.
4. Tap **B-Scan**.
5. Tap **Save**.
6. Enter a file name and tap **Save**.

Export A-Scan Images to USB

To export the A-Scan image

Figure 6-18 Capture A-Scan image



1. Position the cross hair on the B-Scan to obtain the required A-Scan.
2. Tap **Capture**.
3. Insert a USB device, ensure **USB Drive connected** is displayed.
4. Tap **A-Scan**.
5. Tap **Save**.
6. Enter a file name and tap **Save**.

Export a Scan to CSV or XLSX

Thickness measurement data of a scan can be exported onto a USB drive in either a CSV file format or a Microsoft Excel Workbook file format. During the exporting process of a CSV, the step and delimiter symbol must be selected.

To export the scan thickness data to CSV:

1. Tap **Export Scan**.

Figure 6–19 Export scan window

2. Insert a USB device, ensure **USB Drive connected** is displayed.
3. Set the export step.
4. Select the required File Type, either Excel (.xlsx) or Comma Separated values (CSV).
5. When exporting as a CSV format select the delimiter symbol
6. Tap **Export Scan**.
7. Tap **Save**.

Loading a CSV file in Microsoft Excel

When loading a CSV file in to Microsoft Excel, use the Text Import Wizard tool and select the same delimiter symbol used to export the data.

Exporting Inspection Data

Export All Scans

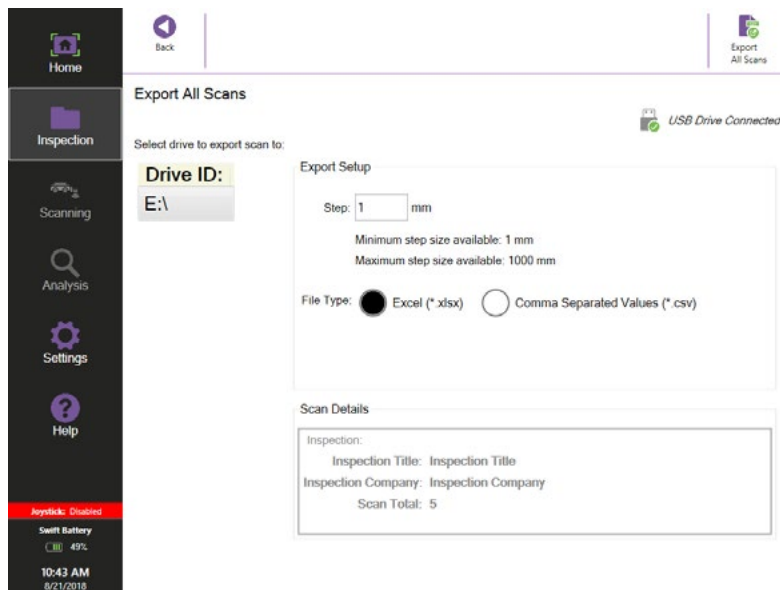
All scans contained within the current inspection can be exported to an external USB drive. The thickness measurement data can be exported in either a CSV file format or a Microsoft Excel Workbook file format.

No data is removed from Swift when using this export function, so any old inspection data must also be removed from Swift.

To export the data from Swift unit:

1. Tap **Inspection** on the sidebar to load the Inspection Details window.
2. Tap **Export All Scans**.

Figure 6–20 Export All Scans window



3. Insert the external USB drive into the USB port.
4. Set the export step.
5. Select the required File Type, either Excel (.xlsx) or Comma Separated values (CSV).
6. When exporting as a CSV format select the delimiter symbol.
7. Tap **Export All Scan**.
8. A message box appears once the export process is complete. Tap **OK** to continue.

A folder, named as the Inspection Title details, is created on the external USB stick and each scan is saved as a separate file type within the folder.

During the export if the folder name already exist a message box appears asking to overwrite it. Tap **Yes** to continue.

Export Inspection

The inspection data on Swift can be exported to an external USB drive. No data is removed from Swift when using the export function, so any old inspection data must also be removed from Swift.

To export the data from Swift unit:

1. Tap **Inspection** on the sidebar to load the Inspection Details window.
2. Tap **Export Inspection**.
3. Insert the external USB drive into the USB port.
4. Tap **Export Inspection**.
5. Enter a file name then tap **Save**.

The exported file is saved in a .CMX format which can only be viewed using the CMAP reporting software.

Finish Inspection

Once the scanning and data analysis of an inspection is complete, the inspection can be closed.

1. Tap **Inspection** on the sidebar.
2. Tap **Finish Inspection**.

Deleting an Inspection from Swift

1. Tap **Home**.
2. Tap **Load Inspection**.
3. Select the required inspection for removal and tap **Remove Inspection**.
4. Follow the onscreen instructions to complete this operation.

Deleting All Swift User Data

To delete all the user data on Swift:

1. Connect a USB keyboard to one of the Swift's USB ports.
2. Tap **Help** on the sidebar.
3. Tap or click inside the Help section.
4. On the keyboard press ALT+ F2. A confirmation dialog box appears.
5. Follow the onscreen instructions to complete this operation.

All the user data is removed from the instrument.

Chapter 7

Troubleshooting and Maintenance

Maintaining Swift

Because of its design, Swift instrument only requires minimal maintenance. Since Swift has no moving parts, it also does not require any preventive maintenance. We recommend a regular inspection of the instrument to ensure that it is properly grounded. We also strongly recommend that an annual calibration and a factory-performed preventive maintenance is conducted by an officially qualified Eddyfi technician.

Cleaning Swift

It is recommended that the instrument is cleaned after every inspection.

1. Make sure that the instrument is off and that the AC power adaptor is disconnected.
2. To bring the instrument back to its original finish, clean it with a soft cloth.



WARNING!

Do not spray the instrument with chemical cleansers or water. Doing so may lead to short circuits and damage to the instrument.

Important

To remove stubborn stains, use a cloth moistened with soft, soapy solution. Do not use abrasives or strong solvents as they could damage the finish. Wait until the instrument is completely dry before connecting the power cord or cables.

Updating and Upgrading Software

Before performing any maintenance on the software, first meet the following requirements:

- USB mass storage device with a minimum of 4 GB free space
- Hardwired Internet connection

There are two methods of updating or upgrading the software.

Standard Method

1. Connect Swift to a power outlet with the power cable.
2. Turn on Swift and wait for the software to start.
3. Download the *.SwiftUpdate file from the Silverwing Web site.
Save the file in an easy-to-remember location on your computer.
4. Copy the *.SwiftUpdate to the root of a USB mass storage device.
5. Once copied, remove the mass storage device and connect it to one of Swift's two USB ports
A dialog box appears prompting you to proceed.

Important

Do not connect your mass storage device to the QUICK COPY USB port.

6. Tap **Yes**.
7. In the list that appears, tap the desired update file, and then tap **Update**.

Important

If performing a complete Swift OS update, perform steps 8 to 10. In the case of a software update, the instrument restarts automatically.

8. To select **Yes**, press the keypad's up arrow. Press any other button to select **No**.
You are prompted to confirm again.

9. Press the keypad's up arrow again.
The update process starts. This normally takes between 5 and 10 minute, depending on the speed of your mass storage device. When the process is complete, the system restarts.
10. Activate Windows.
See Activating Windows on page 68 for details.

System Recovery Method

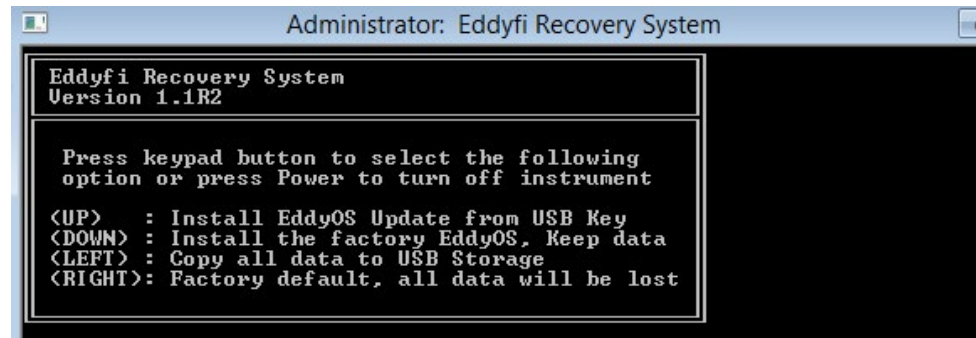
1. Connect Swift to a power outlet with the power cable.
2. Make sure that Swift is off.
If it is not, turn it off.
3. Turn on the instrument.
4. Immediately and simultaneously press the nudge forward button and the zoom out button until the following appears.

Figure 7-1 Options menu



5. With the keypad arrows, select **Enter Eddyfi System Recovery**, and then press the Enter button.
You are prompted to wait until the following appears.

Figure 7-2 System recovery interface



6. Using the keypad arrows, select **Install the factory EddyOS update, keep data**.
7. When prompted, press the up arrow of the keypad.
The update process starts. This normally takes between 5 and 10 minute. When the process is complete, the system restarts.
8. Activate Windows.

Activating Windows

Microsoft requires that you activate Windows to be able to use it. The activation process is automatic when you connect Swift to the Internet through an Ethernet cable. To proceed:

1. Make sure that Swift is on and that the software is running.
2. Connect an Ethernet cable to Swift.
3. Connect the other end of your Ethernet cable to a network (local area network or other access point).

Wait until a dialog box confirming the activation of Windows appears on screen. If you do not activate Windows, every time you start Swift, a message will remind you to do so. You have 30 days to activate Windows before it locks up.

Known Issue with System Updates/Upgrades

On some units, a blue Windows error screen may appear when you attempt to enter the system recovery, which can cause the unit to start normally. Try performing the update procedure again.

Troubleshooting

Troubleshooting System Updates/Upgrades

- **No update file found:** This appears in the update list or in the system recovery. Make sure that you only have one USB mass storage device connected to Swift. Also make sure that the file is in the root folder of the device.
- **Cannot display the options screen:** You do not press and hold the nudge forward button and the change layout button long enough, you do not press and hold the correct buttons, or you do not press and hold the buttons quickly enough after turning on Swift. Try holding the power button for two seconds, and then quickly pressing and holding the nudge forward button and the zoom out button.
- **Using the system recovery method:** Swift restarted normally or a blue error screen appeared on the screen. Perform the procedure again.
- **Unable to activate Windows:** Make sure that your Ethernet cable is functional. Make sure that you have Internet access. Make sure you are using DHCP. Turn on Swift after connecting the Ethernet cable and network. If you do not see a message warning you that Windows is not activated when it starts, Windows is activated.

Scorpion2 Crawler Maintenance

Scorpion2 crawler is designed for minimal maintenance. After each inspection it is recommended that some preventative maintenance is performed due to its moving parts as well as cleaning around critical components. We also strongly recommend that an annual calibration and factory-performed preventive maintenance is conducted by an officially qualified Silverwing technician.



WARNING!

Do not attempt to unscrew and remove the main body cover of Scorpion2 crawler. This can compromise the integrity of the seal and cause damage to internal components. Damage to the seal or removal of the lid will void the manufacturer warranty.

Drive Wheels

Clean any build-up of debris in the treads of the four drive wheels. Also clean any build-up between the wheels and the crawler chassis. During use on wet or dusty surfaces, the wheels may spin and become polished. If they do become polished, lightly roughen the surface with 120 grit emery cloth.

Encoders

Clean any build-up of dirt around each encoder wheel. Check there is sufficient spring pressure to keep the encoder wheels in contact with the surface at all times. Ensure the encoders do not get damaged during use, as this could cause issues with the automatic drive and steering of the crawler as well as distance measurement inaccuracies.

Cabling

Check all cabling for any damage that could have been caused during use. Do not walk, stand, trap or place objects on top of the umbilical cable. If a cable is damaged, do not use until it is repaired.

Dry Coupled Wheel Probe

The dry coupled rubber of the wheel probe is most effective when the contact surface is slightly tacky. As the Wheel Probe picks up dust and debris from the surface, it becomes less effective. A cleaning pad removes any dust and debris from the wheel probe and applies a thin film of oil to help improve coupling. Silicone oil, such as silicone brake fluid, should be manually applied to the cleaning pad to ensure that it remains moist.

Discoloration of the wheel probe tire suggests they need to be cleaned using a cloth moistened with acetone. This helps to restore the tire to their original 'tacky' condition. The frequency of cleaning depends upon the condition in which the unit is being used, for example where the paint surface is particularly dusty (or coated with a thick 'bloom'), it may be necessary to clean the tires after each scan.

WARNING!



Only use silicone oil to moisten the cleaning pad. Any other form of mineral oil will damage the wheel probe tires.

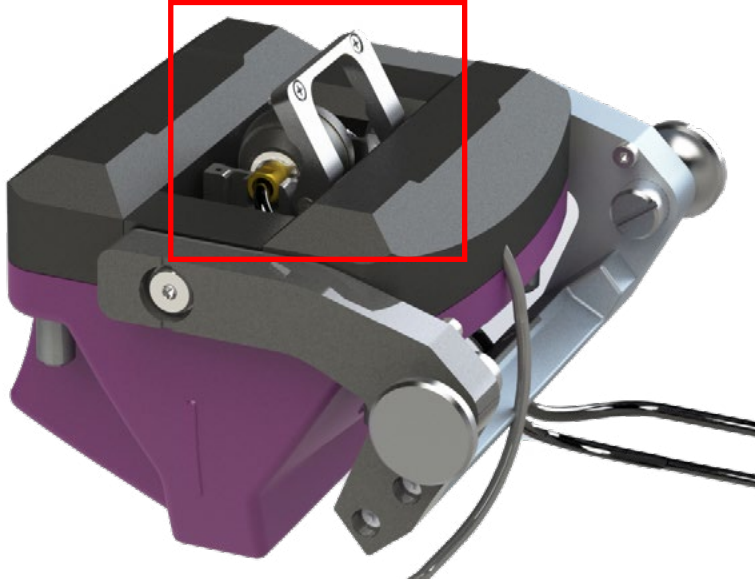
The use of any 'oil' other than specified by the manufacturer will invalidate the warranty on the wheel probe tires.

Wheel Probe Removal

To remove the wheel probe from the probe holder:

1. Disconnect the two Lemo00 connectors at the front of the crawler.
2. Unscrew the two screws of the probe housing lid and lift open.

Figure 7-3 Wheel probe removal



3. Remove the wheel probe from the probe housing. Ensure the wheel probe cables and Lemo00 connectors feed through the probe holder cover.

Cleaning Pad Replacement

The cleaning pad is located within the inner probe sleeve, above the wheel probe. To replace,

1. Remove the wheel probe.
2. Remove the old cleaning pad from the probe housing.
3. Slide in a new cleaning pad.
4. Replace the wheel probe.

Wheel Probe Replacement

To replace the wheel probe into the probe holder:

1. Pass the wheel probe cables and Lemo00 connectors through the guides in the probe holder cover.
2. Refit the wheel probe into the probe housing. Ensure the markings on the axle face downwards towards the inspection surface.
3. Close the probe housing lid and secure the two screws.
4. Connect the Lemo00 connectors back to the front of Scorpion2.

Wear Runners

Clean any build-up of dirt around the wear runners. Check the surface for any damage or deep scoring. Replace when the edge wear marks have worn flat.

R-Scan Maintenance

R-Scan scanning head is designed for minimal maintenance. After each inspection, it is recommended that, due to its moving parts, some preventative maintenance and cleaning around critical components is required. We also strongly recommend that an annual calibration and factory-performed preventive maintenance is conducted by an officially qualified Silverwing technician.

Wheels

Clean any build-up of debris around the magnetic wheels. Check for any cuts or damage to the rubber tires.

Encoders

Clean any build-up of dirt around the encoder wheel and gearing.

Dry Coupled Wheel Probe

The dry coupled rubber of the wheel probe is most effective when the contact surface is slightly tacky. As the Wheel Probe picks up dust and debris from the surface, it becomes less effective. A cleaning pad removes any dust and debris from the wheel probe and applies a thin film of oil to help improve coupling. Silicone oil, such as silicone brake fluid, should be manually applied to the cleaning pad to ensure that it remains moist.

Discoloration of the wheel probe tire suggests they need to be cleaned using a cloth moistened with acetone. This helps to restore the tire to their original 'tacky' condition. The frequency of cleaning depends upon the condition in which the unit is being used, for example where the paint surface is particularly dusty (or coated with a thick 'bloom'), it may be necessary to clean the tires after each scan.

WARNING!

Only use silicone oil to moisten the cleaning pad. Any other form of mineral oil will damage the wheel probe tires.

The use of any 'oil' other than specified by the manufacturer will invalidate the warranty on the wheel probe tires.



Wheel Probe Removal

To remove the wheel probe from the R-Scan probe holder:

1. Remove the four screws holding the top cover in place.
2. Use the Lemo extraction tool provided to release each co-axial connection by pushing from the front of the umbilical connector.
3. Remove both co-axial connectors by pulling out from the rear of the umbilical connector.
4. Remove the rear non-encoded wheel assembly and spacers either side by removing a circlip from one side of the axle then slide out.
5. Remove both wheel probe retaining bolts from the R-Scan probe holder using the 2.5mm Allen key and 5.5mm spanner provided.
6. Carefully remove the wheel probe from the R-Scan probe holder by applying equal pressure on both sides.

Cleaning Pad Replacement

The cleaning pad is located at the top of the R-Scan probe holder, above the wheel probe.

To replace:

1. Remove the wheel probe.
2. Remove the old cleaning pad from the probe holder.
3. Slide in a new cleaning pad and apply silicone oil.
4. Replace the wheel probe.

Wheel Probe Replacement

To replace the wheel probe into the R-Scan probe holder:

1. Refit the wheel probe into the probe housing. Ensure the markings on the axle face downwards towards the inspection surface.
2. Replace both wheel probe retaining bolts securing the wheel probe into the probe holder.
3. Refit the co-axial connectors into the rear of the umbilical connector. Ensure they are replaced in the correct order. The marked cable (identified) must fit into the upper (nearest the top cover) socket.
4. Check that all cables are clear from fouling on the springs then secure top cover using the four pan head screws.
5. Check that the wheel probe is free to rotate.
6. Add a little silicone oil to each side of the cleaning pad located at the top of the wheel probe then check for good signals through one full turn of the tyre.

Dry Coupled Wheel Probe Servicing

After removing the wheel probe from the Scorpion2 or R-Scan it can be stripped down by removing the tire and cork washer for cleaning.

Wheel Probe Strip Down

1. Using the circlip pliers, remove both circlips on either side of the wheel probe axle.
2. Remove the side plates then carefully slide each of the wheel probe tires away from the transducer, over the axles and onto the cables.

Inspection and Cleaning

Inspect the tires for any signs of splitting, cracking, excessive abrasion or any evidence of swelling due to contact with mineral oil. Check the condition of the cork insulating washer and ensure that it sits snugly and turns freely in the groove. Check that the ball bearings in the side plates turn freely.

Use acetone to clean all components and surfaces. Take extra care that all traces of film and dirt are removed, especially around the outer circumference and Perspex plug over the crystal and the inner face of the wheel probe tires.

Tire Replacement

If new tires are to be fitted, it is very important they are first cleaned with acetone to remove the protective film.

Wheel Probe Re-Assembly

1. Using the syringe, draw up a small amount of silicone oil from the source bottle and apply a small amount of silicone oil to the inner face of the wheel probe tires.
2. Inspect the cork washer for correct fit / damage.
3. Re-fit the tires, side plates and circlips. Check for a positive 'click' when securing the circlip, to ensure it is seated correctly in the groove.

Appendix A

Using the Optional Harness

Adjusting the Harness

Harnessing Swift requires a number of specific adjustments so that you feel comfortable wearing the harness.

Adjusting the Harness to your Body

1. Grab the harness shoulder straps and slip it over your shoulders as you would a jacket.

Figure A-1 Slipping the harness on



2. Verify the fit of the harness.
Visualize working with Swift before making any adjustments to the shoulder straps and height of the belt.
3. Slip out of the harness.
4. Use the underarm straps and shoulder blade rings to adjust the fit of your shoulder straps. You may need to perform this adjustment several times to get the proper fit.

Figure A-2 Adjusting the shoulder straps



5. Use the back and side belt straps to adjust the height of the harness' belt to suit your body type.

You may need to perform this adjustment several times to get the proper fit.

Note

Your belt's height determines the lowest position of Swift. Adjust this height so that the display of the instrument is easy to see—for that, the belt could end up higher than your hips.

Figure A-3 Adjusting the belt's height



6. Once your belt and shoulder straps are adjusted, clip and tighten the chest straps.

Figure A-4 Securing the chest straps



7. Secure the belt around your waist, according to the height you have adjusted it.

Figure A-5 Securing the belt



8. Make sure that the harness fits snugly.
9. Make sure that the harness' shoulder anchor straps are loose.

Figure A-6 Shoulder anchor straps



10. Unfasten the two straps at each end of the shoulder anchor straps.
Place them within hands reach. You will need them.

Figure A-7 Unfastening the straps



11. Sit down.
12. Place Swift horizontally in your lap.
13. Slip the looped portion of the strap removed above in the hook of one of the two upper Swift bumpers, as illustrated.

Note

Illustrated here is [Reddy](#). Manipulations on Swift are the same.

Figure A-8 Sliding strap loop through bumper hook



14. Slip the clip through the strap hoop, and then pull to tighten into place, as illustrated.

Figure A-9 Securing anchor strap



15. Repeat the previous two steps for the opposite upper bumper.

Note

You can also secure the straps to the bumpers in a more elegant and less easy-to-remove fashion, as illustrated here.

Figure A-10 Alternative method of securing anchor strap to bumper



16. Locate the anchor strap on the harness' belt.

Figure A-11 Anchor strap on harness belt



17. Open the battery compartment door and slip the male buckle of the anchor strap.

Figure A-12 Slipping male buckle through bumper



18. Mate the male buckle to its female counterpart.

Figure A-13 Mating battery compartment side anchor strap



19. Close and secure the battery compartment door.

Figure A-14 Closing battery compartment door.



20. Repeat the procedure for the opposite belt anchor strap (no door to open).

21. Adjust the length of the anchor straps until comfortable.

22. Mate the left male buckle of the shoulder anchor strap to its female counterpart.

Figure A-15 Mating shoulder anchor strap



23. Repeat for the opposite shoulder anchor strap.
24. Tighten each shoulder anchor straps to achieve the desired view angle for Swift.

Figure A-16 Tightening shoulder anchor straps

