Hydrosteel 6500

Instrument User Manual V2.0

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Thank you for purchasing your Ion Science instrument.

The standard warranty of your instrument can be extended to two years.

To receive your extended warranty, you must register your instrument online within one month of purchase (terms and conditions apply).

Click here to extend your instrument warranty, or scan the QR code below.

Contents

Introduction

The Hydrosteel 6500 is an intrinsically safe instrument for the measurement of hydrogen flux. Hydrogen flux from steel is caused by mobile hydrogen in steel exiting the steel surface, after various corrosive and high temperature processes.

The Hydrosteel unit has two modes of operation:

1. Spot flux measurements - Allows for quick, targeted assessments of hydrogen flux.
2. Fixed probe flux monitoring - Supports up to four probes for continuous monitoring.

This dual capability may be used to locate multiple corrosion 'hot spots', which can then be monitored for days or weeks to enable an optimal means of corrosion control to be identified.

In survey mode, the instrument draws an air sample continuously from one pre-selected instrumental gas port out of four ports available. The gas ports on the Hydrosteel 6500 connect to roaming probes via a flexible conduit. The instrument operator typically positions the probe at multiple locations. The locations may be distributed over a large facility, or confined to a single location, or corroding pipe or vessel, for example. In this mode, the instrument and probes can be conveniently carried in an instrument case provided with the instrument.

In monitoring mode, all four gas ports may be engaged in the monitoring of flux from up to four corresponding probes. The conduits may be up to 10 m in length, if the instrument monitoring time is for more than a few days, it is likely the instrument will be secured to a station or post.

Designed for minimal maintenance, the Hydrosteel 6500 operates for at least one year without requiring servicing. During flux monitoring, real-time information on the instrument's display is limited. Data retrieval is performed via USB connection to a PC using Hydrosteel software, while battery recharging is done separately via the dedicated charging port. Both tasks must be carried out in a non-hazardous area. For data collection and charging in hazardous areas, refer to the Permanent Installation Safety Guidelines section of this manual.

Patent Information: The Hydrosteel 6500 is protected by an active patent: **GB2538113**.

Safety

Legal Notices Regarding the Safe Operation of Equipment

- Whilst every attempt is made to ensure the accuracy of the information contained in this manual, ION Science accepts no liability for errors or omissions in the manual, or any consequences deriving from the use of information contained herein. It is provided “as is” and without any representation, term, condition or warranty of any kind, either expressed or implied.
- To the extent permitted by law, ION Science shall not be liable to any person or entity for any loss or damage which may arise from the use of this manual.
- We reserve the right at any time and without any notice to remove, amend or vary any of the content which appears in this manual.

Symbols

	**WARNING!** USED TO INDICATE DANGER WARNINGS WHERE THERE IS A RISK OF INJURY OR DEATH.
	**Caution** Used to indicate a caution where there is a risk of damage to equipment.
	**Information** Important information or useful hints about usage.
	**Recycling** Recycle all packaging.
	**WEEE Regulations** Ensure that waste electrical equipment is disposed of correctly.

Safety Warnings, Cautions and Information Notifications

Understand and follow the operating instructions carefully:

- No user serviceable parts inside
- Lithium battery inside
- Please read and understand this user manual fully before installing, operating or servicing the Hydrosteel 6500
- 'X' on the label refers to:
    - The quick fit tube connectors used on the front face of the instrument.
      The tube connector ringed bezels are made of aluminium and must be protected from potentially incendive impact or abrasion.
- The USB connector and USB flying cap on the front face of the instrument:
    - Both the USB connector and USB flying cap have an aluminium body and must be protected from potentially incendive impact or abrasion.
    - The captive end stud of the cap is made of stainless steel.
- Ensure you are in a non-hazardous area before carrying out any type of maintenance on the Hydrosteel 6500 instrument
- For ambient charging up to 50 °C the batteries may be recharged at 100 mA in an intrinsic safe area or a non-hazardous area using the following specified source:
    - Pepperl &Fuchs KFD0-SD2-Ex1.10100 and Ion Science 10 V voltage limiter P/N:6500133.
      Hydrosteel entry requirements: Ui = 10 V Ii = 271 mA Pi = 1.152 W Ci = 0 µF Li = 0 µH.
      Maximum permitted cable parameters for interconnecting cable (Group IIC) Cc = 3 µF Lc = 484 µH or Lc / Rc = 33 µH / Ω
- Batteries recharged in a non-hazardous area must be at ambient temperature not exceeding 45 °C.
- Use ISL supplied 230 VAC mains power supply delivering 10 V and 0.5 A for maximum charging rate
- Substitution of components may impair intrinsic safety and result in unsafe conditions
- For safety reasons, the Hydrosteel must only be operated and serviced by qualified personnel
- Refer to the certificate for clarification of any aspects of intrinsic safety or contact Ion Science Ltd or your local Ion Science Ltd representative
- If using in high temperatures use thermally insulating gloves to handle roaming probes
- Do not connect or disconnect any cables in hazardous areas and do not use non-approved equipment in hazardous

Safety, Hazard and Warning Symbols on the Instrument

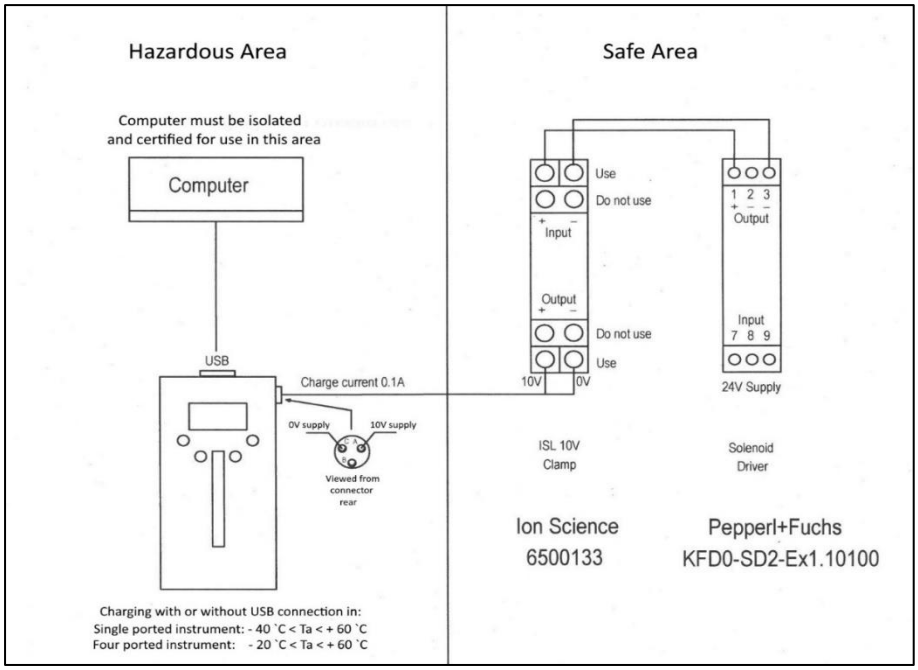
This paragraph details the various safety and hazard icons on the instrument's outer case.

Icon	Description
	Conforms to the European Explosive Atmosphere (ATEX) directive
	Caution: Refer to user guide
	Caution: hot surface
	EU conformity: Equipment complies with current EU directives
	Do not dispose of to landfill, in sewage systems or by fire
	This device supports Type B as described in the USB Implementers Forum, Cable and Connector Specification Release 2.0
	The Hydrosteel 6500 contains a Lithium-ion battery. Do not mix with the solid waste stream. Spent batteries should be disposed of by a qualified recycler or hazardous materials handler per local regulations. Contact your authorised ION Science Service Centre for recycling information

Permanent Installation Safety Guidelines

Permanent installation is possible, and this will require further guidance from Ion Science for specific usage. For certification purposes the basic requirement is as follows: an instrument connected in a fully discharged state will require about 80 hours to fully charge using the 100 mA 10 V intrinsically safe supply detailed in Permanent Installation section below. Charging will require a longer time if the instrument is data collecting. Charging in non-hazardous areas using the 0.5 A 10 V charger supplied takes up to 16 hours from a fully discharged state.

Permanent Installation



NOTE: Any permanent installation should be wired in accordance with local regulations relating to the zone the instrument is placed within.

Disposal

- The equipment does not include any toxic materials, but if it has been contaminated by toxic materials, then exercise due care and follow the appropriate regulations when disposing.
- Always adhere to local regulations and procedures when disposing of the equipment.
- Ion Science Ltd offers a take back service. Please contact us for more information.

RECYCLING
Recycle all Packing.

WEEE REGULATIONS
Ensure that all waste electrical equipment is disposed of correctly.

Statements

Responsibility for Correct use

Ion Science Ltd accepts no responsibility for incorrect adjustments that cause harm or damage to persons or property. The users are responsible to respond appropriately to the readings and alarms given by ION instrumentations.

Use the equipment in accordance with this manual, and in compliance with local safety standards.

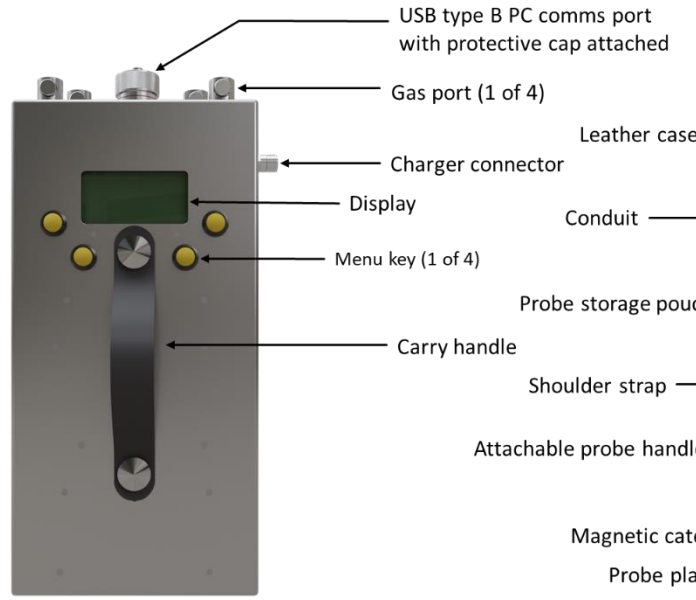
Reduced performance of gas detection might not be obvious, so equipment must be inspected and maintained regularly. Ion Science recommends that you use a schedule of regular checks to ensure it performs within calibration limits, and that you keep a record of calibration check data.

Unpacking and Inspection

Upon removing your new Hydrosteel from its packing, you should have the following items:

Item	Description	QTY
1	Hydrosteel 6500	1
2	Hard Case with foam inserts	1
3	Hydrosteel 6500 leather carry case with carry strap	1
4	Large roaming probe assembly	1
5	Small roaming probe assembly	1
6	Large collector plate assembly	1
7	Small collector plate assembly	1
8	Staubli® RBE3 1 metre conduit to collector plate assembly	1
9	Staubli® RBE3 2 metre conduit to collector plate assembly	2
10	Staubli® RBE3 4 metre conduit to collector plate assembly	1
11	Hydrosteel 6500 configured Staubli adaptor	1
12	100-240 V 50/60 Hz to 10 V Hydrosteel 6500 charger	1
13	Mains Lead IEC C7 2m Type I plug	1
14	Mains Lead IEC C7 2m Type G plug	1
15	Mains Lead IEC C7 2m Type A plug	1
16	Mains Lead IEC C7 2m Type C plug	1
17	Probe Plate 2 mm Allen key	1
18	Probe Plate Spanner Small (8mm)	1
19	Probe Plate Spanner Large (11mm)	1
20	2 metre USB Type-A to right-angle Type-B cable	1
21	User manual	1
22	Warranty registration card	1

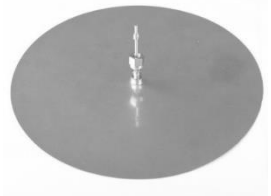
Instrument Overview



Hydrosteel 6500 instrument

Hydrosteel 6500 instrument in case, showing large roaming probe attached and ready to use.

Instrument Large Roaming Probe

Image	Description	Part number
	LR - large roaming probe	A-6500256
	Roaming probe handle	6500251
	LR probe plate	A-6500261

NOTE: Hydrosteel roaming probes for surveying and short-term surveys

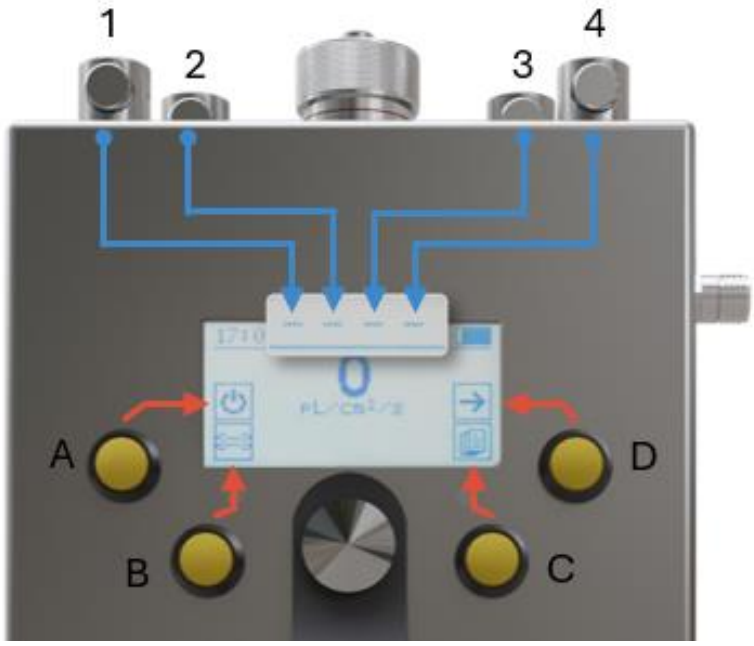
Instrument Small Roaming Probe

Image	Description	Part number
	SR - Small roaming probe	A-6500257
	SR probe plate	A-6500262

Gas Sample Conduits

Image	Description	Part number
	1 metre Hydrosteel 6500 conduit	A-6500267
	2 metre Hydrosteel 6500 conduit	A-6500268
	4 metre Hydrosteel 6500 conduit	A-6500269

Instrument Gas Port and Button Mapping

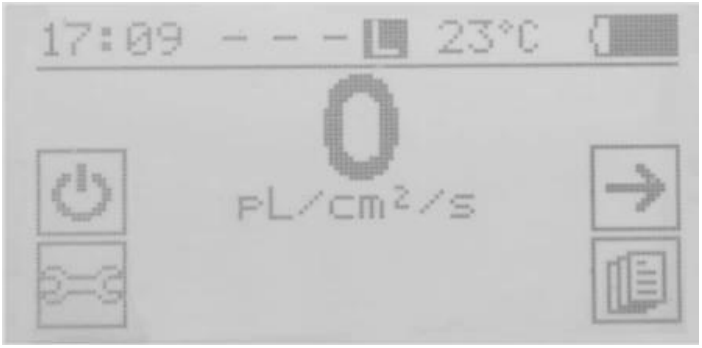


Hydrosteel 6500, gas port and button mapping panel consist of:

1. Four gas ports (labelled 1, 2, 3, and 4) at the top, used to connect probes for gas sampling. The blue lines indicate how these ports correspond to inputs on the display.

2. Four yellow push buttons (labelled A, B, C, D), which act as softkeys for controlling the device and navigating the menu. The orange arrows indicate the corresponding functions on the display.

Display



Item	Name	Description
	Time	The displayed time this is set by the PC operating program and not used for logging data; that is set by the PC to which data is downloaded.
	*Gas ports*	*Gas ports 1 to 4 corresponding to their probe assignments*
	Temperature	the temperature in the instrument
	Battery	Battery level status
	Power ON/OFF	Power the unit on and off
	Left and right key	Move highlighted option left or right
	logging	Data logging menu
	Settings menu	
	Exit	Exit to previous menu level
	Select	Select highlighted option
	Port status	Port 1: Active sampling with HT-S probe attached Port 2 and 3: Not in Use Port 4: Background Measurement
	Active Sampling	Port 1 to 3: Not in Use Port 4: Active sampling, attached to LR probe.

NOTE: If the temperature in the instrument is changing by more than 1 °C per second (for example if the instrument is brought into a hot location), the temperature display flashes, as this rate of temperature change affects the zero measurement. The temperature will stop flashing on the display once the unit has stabilised to its environmental conditions. The instrument should be allowed to stabilise to ensure correct auto zero measurement calibration.

Gas Port Status

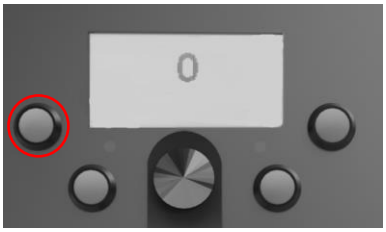
The top-middle section of the display indicates the status of the four gas ports, using the following symbols:

Symbol	Description
L	LR – Large roaming probe
A	SR – Small roaming probe
S	AT-S – Large stationary probe – optional accessory
H	HT-S – High temperature (small) stationary probe – Legacy support
O	Open gas port for background measurement
-	Closed gas port

Operation

Powering the Instrument on and off

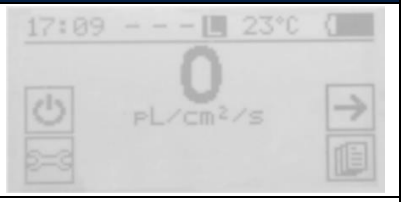
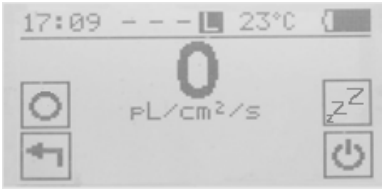
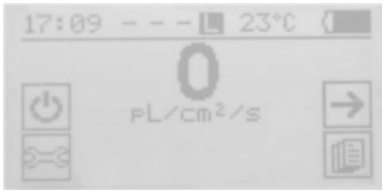
After the Hydrosteel 6500 is first powered on (steps 1 to 3 below are complete), the instrument will display a 60 second countdown timer whilst the unit warms up. The 60 second warmup cannot be skipped.

Description	Image
To turn the instrument on: 1. Press any softkey A to D 2. Hold until the countdown has reached "0" on the main display 3. Release the button and the ION Science logo splash screen should briefly show on the display	
4. The display will show the current firmware version on the screen for 3 seconds before showing the warmup countdown 5. The warming up menu will be displayed and 60 second warmup countdown will start (this cannot be skipped) 6. Once the unit has finished warmup the instrument will be ready for use and the main display will show pL/cm^2/s reading	
7. Turning the instrument off: 8. Press the softkey A that corresponds to the ⏻ icon on the display	
9. The ⏻ will then move to the bottom right 10. Press and hold softkey C down for 3 seconds 11. Release the softkey and the instrument will power off	

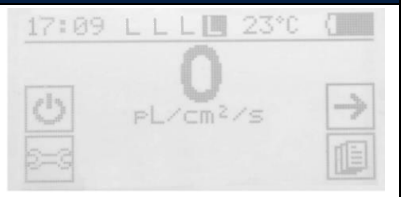
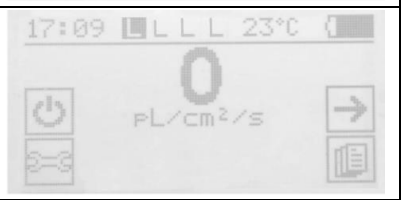
NOTE: If the instrument doesn't appear to power on ensure it has enough power to turn on. A severely depleted battery may need several minutes of charging before displaying any indicators (see Battery Information section for more information).

Sleep Mode

To save battery between surveys whilst allowing the unit to return to operation quickly, the Hydrosteel has a sleep mode. To put the unit into Sleep Mode and Wake it again:

Description	Image
To put the unit to sleep: 1. Press and release the softkey A	
The submenu will now show: 2. Press and release softkey D	
3. The display will turn off	
Waking the instrument up: 4. Press and release any of the softkeys A, B, C or D and the unit will come back on showing the main menu	

Changing the Actively Sampled Gas Port

Description	Image
When multiple gas ports are allocated changing between which one is can be done from: 1. The main menu, press softkey D	
2. The highlighted symbol will move to the next available probe port and the instrument switches its flow to that port instantaneously.	

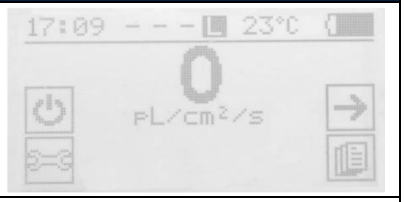
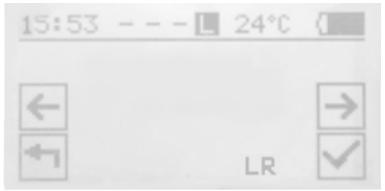
The Tools Menu

Navigating the Tools Menu

The Tools menu is navigated by means of the four menu keys A, B, C and D. The function provided by each key is identified in the four corresponding corners of the display as shown:

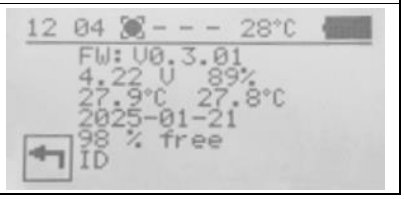
	Left key: move highlighted option left		Right key: move highlighted option right.
	Up key: Moves up a page or moves move highlighted option up		Down key: Moves down a page or moves move highlighted option down
	Select key: select highlighted option		Exit key: exit to previous menu level

Changing the Probe Type

Description	Image
1. From the Main menu, press the softkey B menu key then, use the navigation keys to highlight and select the Probe icon:	
2. Use the softkey A to scroll left and softkey D to scroll right through the desired probe options: • AT-S • HT-S • PPM • LR • SR 3. Press softkey C to confirm the desired probe option a. To escape without making any changes press softkey B ignore the selection and return to the main menu	

NOTE: Any gas ports previously allocated to a flux probe will now identify the newly designated probe.

Unit Information

Description	Image
1. From the Main menu, press the softkey B menu key	
2. Use the softkey A to scroll left and softkey D to scroll right to highlight the icon	
3. To view the instrument information press softkey C 4. To return to the main menu press softkey A	

Display Backlight

Description	Image
1. From the main menu, press the softkey B menu key	
2. Use the softkey A to scroll left and softkey D to scroll right to highlight the icon 3. Press softkey C to enter the sub menu	
4. Use the softkey A to scroll left and softkey D to scroll right to select the desired backlight settling: • No backlight • 15 seconds • 30 seconds 5. Press softkey C to confirm the selection 6. Press softkey B to exit without making any changes	

Temperature Scale

Description	Image
1. From the main menu, press the softkey B menu key	
2. Use the softkey A to scroll left and softkey D to scroll right to highlight the icon 3. Press softkey C to enter the sub menu	
4. Use the softkey A to scroll left and softkey D to scroll right to select the desired temperature scale: • °C • °F 5. Press softkey C to confirm the selection 6. Press softkey B to exit without making any changes	

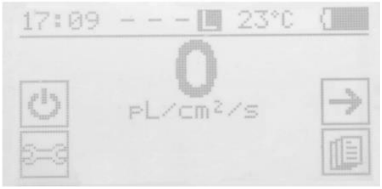
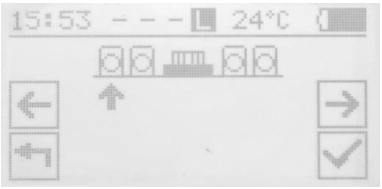
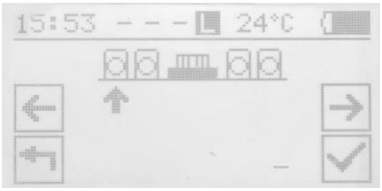
Sequential Flux Monitoring Measurement Time

Sequential monitoring of each active gas port is over a pre-defined period identified in the flux measurement time menu. This can only be adjusted from the Main menu before logging is initiated. The default setting is 60 s monitoring per gas port per cycle.

Description	Image
1. From the Main menu, press the softkey B menu key	
2. Use the softkey A to scroll left and softkey D to scroll right to highlight the icon 3. Press softkey C to enter the sub menu	
4. Use the softkey A to scroll left and softkey D to scroll right to select the desired duration 5. Press softkey C to confirm the selection 6. Press softkey B to exit without making any changes	

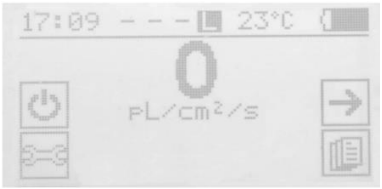
NOTE: The default setting is 60 s. Longer times are recommended at temperatures below 0 °C. Also, with probes attached to 10 m conduit, 90 s is recommended.

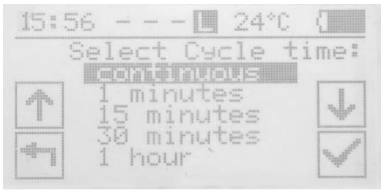
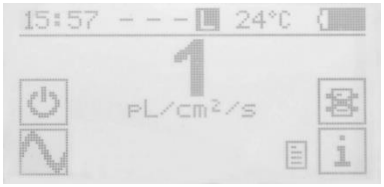
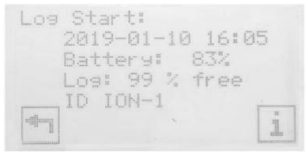
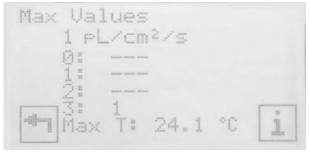
Changing the Probe Allocation of the Gas Ports

Description	Image
1. From the Main menu, press the softkey B menu key	
2. Use the softkey A to scroll left and softkey D to scroll right to highlight the icon 3. Press softkey C to access the probe allocation menu	
4. Use the softkey A to scroll left and softkey D to scroll right to select the desired port as indicated by the arrow 5. Press softkey C to enter the gas port configuration	
6. There are three options in the subsequent menu: 7. Use the softkey A and softkey D to: • Close port ( ) • Set as background probe ( ) • Change current probe selection (LR, SR, AS, HS) 8. Press softkey C to confirm the selection to allocate the identified probe type to the selected gas port and return to the probe allocation menu	

Data Logging Operation

User Defined Data Logging

Description	Image
1. From the main menu press the softkey C to access the logging selection menu	
2. Press the softkey C for the user defined logging.	

3. You will then be presented with various user defined monitoring options. 4. Use ↑ and ↓ to select the desired cycle time: 5. Press softkey C ✓ to confirm the selection 6. Press softkey B ↩ to exit without making any changes	
7. Immediately following the selection of a logging regime, the following is displayed. 8. The page icon indicates that user defined logging is active. 9. The four key options are: 10. Press softkey A for Power off a. The log will be terminated before the instrument powers down. 11. Press softkey B to change monitoring sequence cycle time (as described in steps 3 to 6) 12. Press softkey D to stop data logging 13. Press softkey C to view logging information This is presented in three sequential screens	
To cycle through the log information 14. Press softkey C 15. Press softkey C again to continue cycling through the information pages 16. To cancel and go back press softkey B	  

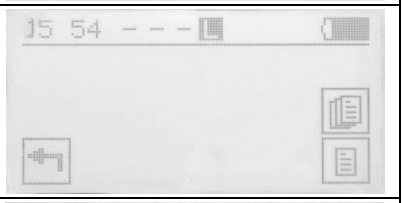
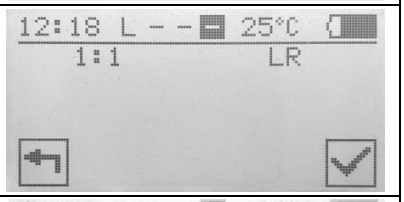
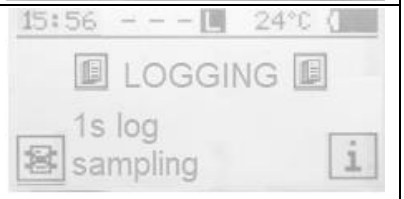
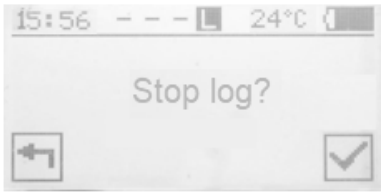
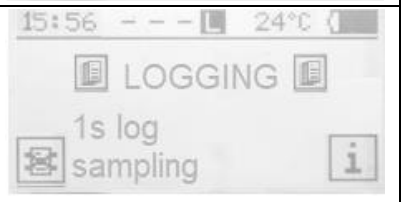
NOTE: To change the probe allocation logging must be terminated.

NOTE: When selecting ‘continuous’ cycle time the instrument will immediately start logging continuously. The monitoring frequency is every 5 seconds from the highlighted flux probe (see Changing the Actively Sampled Gas Port section for more information on how to change highlighted flux probe).

NOTE: For the non-continuous options, the minimum cycle time option available is determine by the Flux measurement (see Sequential Flux Monitoring Measurement Time) and the number of probe ports open. The monitoring sequence commences from each open from gas port 1 to 4 and readings are monitored every 5 seconds.

PC Defined Logging

All monitoring options that can be set by the user can also be pre-programmed into the instrument (see *Hydrosteel PC software* section).

Description	Image
1. From the main menu press softkey C to select the logging tab	
2. In the logging selection menu, then press softkey D to enter the PC logging menu	
3. Press softkey A and D, to select: a. 1SLOG → 1 for 1 sec logging b. 60SLOG → 2 for 60 sec logging 4. Press softkey C to confirm and continue setup 5. Press softkey B to go back without setting up	
6. Press softkey C to confirm the port and probe setup	
To stop data logging: 7. Press softkey B to stop data logging	
8. Press softkey B to confirm 9. Press softkey C to cancel and continue logging	
To see log data information: 10. Press softkey C to enter the logging information menu 11. Press softkey B to see most recent logs 12. Press softkey C to return to logging main menu	

To cycle through the log information

13. Press softkey C
14. Press softkey C again to continue cycling through the information pages
15. To cancel and go back press softkey B

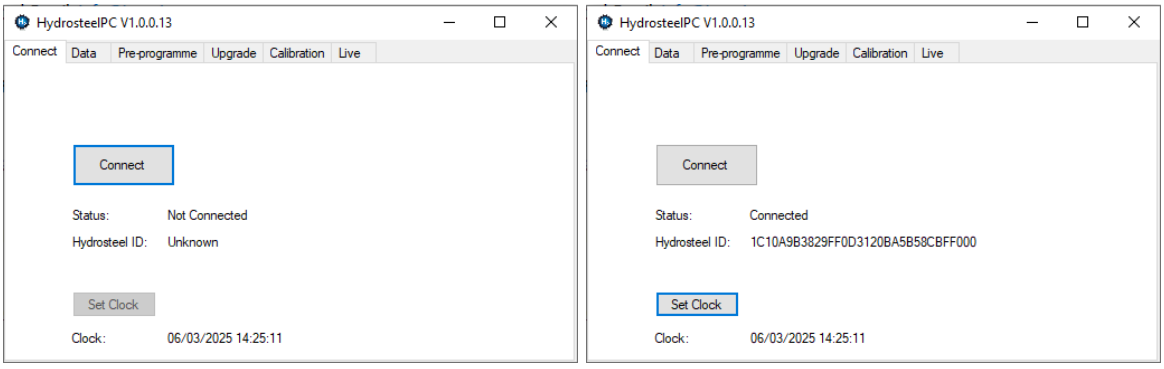
Hydrosteel PC Software

Hydrosteel PC software is used to set up the instrument clock, calibrate the instrument, and pre-set data logging routines, handle instrument data and upgrade firmware. It is supplied on a memory stick with the instrument kit but also is downloadable from the internet.

Set-up

Obtain Hydrosteel PC software from www.ionscience.com or a memory stick. Run the program 'Setup'. This will install the software on your computer. You may need your administrator's permission to load the software.

1. Turn on your Hydrosteel 6500 instrument.
2. Unplug the instrument USB cap and use the USB connector to connect to the instrument to your computer.
3. Run HydrosteelPC.exe from your PC. The window, below left, will appear:



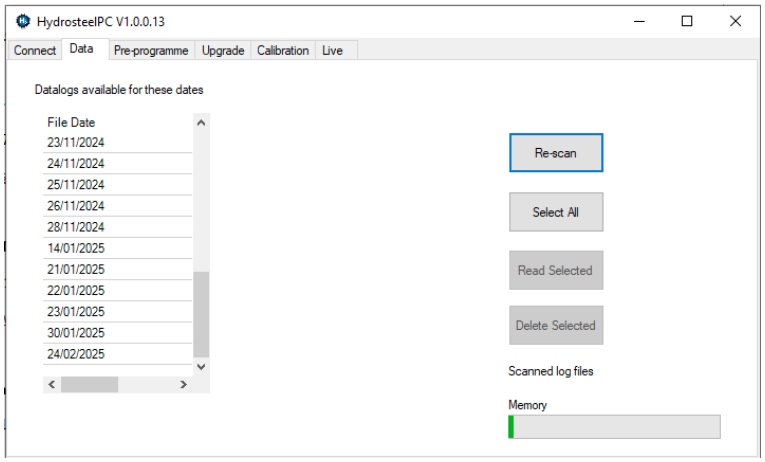
4. Press 'Connect' to obtain the screen above right.
5. The software can now be used for *Data handling*, *Setting the instrument clock*, and *Calibration as* described in the Calibration sections.

Setting the Instrument Clock

From the Hydrosteel PC software Connect window, select ‘Set clock’ and follow instructions. The analyser time and date will be set to the PC time and date.

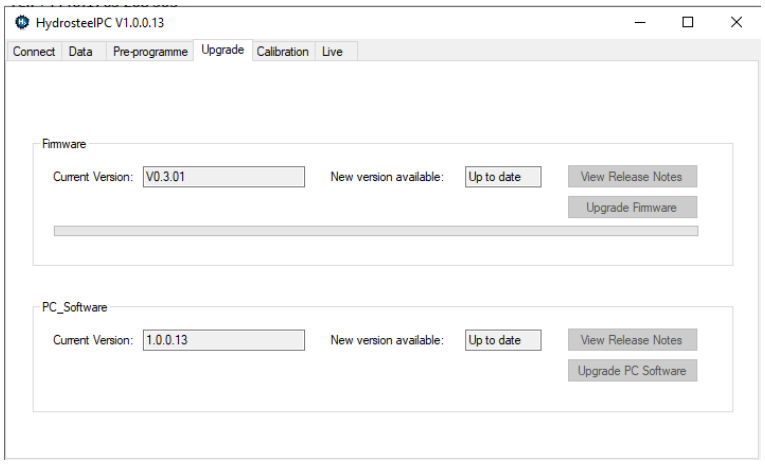
Data Handling

With the instrument connected to Hydrosteel PC software, click ‘Select Data’ to open the log retrieval screen. Click ‘Re-scan’ to refresh and retrieve the latest logs from the instrument. To download a specific log file, select it and click ‘Read Selected’. For bulk downloads, click ‘Select All’ before pressing ‘Read Selected’. To delete files, select the desired logs and click ‘Delete Selected’. Bulk deletion can be performed by clicking ‘Select All’ first, then ‘Delete Selected’.



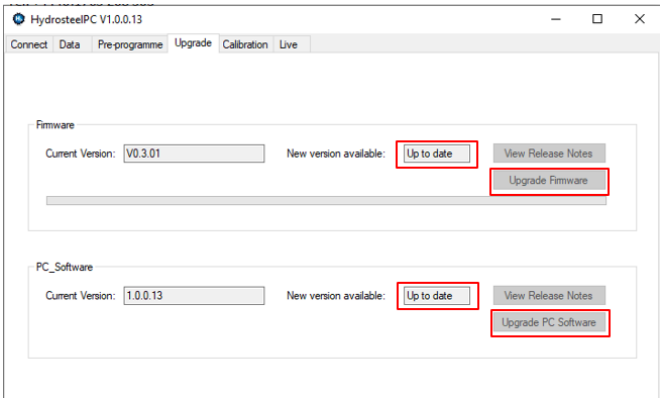
Upgrading Hydrosteel 6500 Firmware

With your PC connected to the internet and Hydrosteel 6500 connected to Hydrosteel PC software click the ‘Upgrade’ tab at the top of the screen.



If there is a newer version of firmware or PC software ‘New version available’ box will show the latest version available. The view ‘Release Notes’ and ‘Upgrade’ button will be enabled.

To upgrade:



1. Select Upgrade to obtain the screen on the left.
2. Select Upgrade firmware.
3. Upgrade progress is indicated as shown in the right screen.

System Assembly and Start-up

Hydrogen flux measurements are sometimes undertaken under the duress of emergent process control issues. Hydrosteel 6500 can be operated 'out of the box', to provide quick measurement of hydrogen flux. However, it is recommended the familiarises themselves with the Instrument Overview and Operation sections of this manual first.

Use of the leather case is recommended for transporting the instrument, even upon retrieving from and returning instruments to a fixed site following battery recharging. The case with full contents should be adjusted so that it fits comfortably and snugly to the person transporting it to the field. Proceed with the appropriate measurement procedure described below.

Roaming Probe Spot Measurement Procedure

Step 1: Ensure the instrument is turned on away from any source of hydrogen. Check that the battery display shows sufficient power for the entire survey (a full battery lasts approximately four days of continuous measurements). Verify that the probe sampling port is set to gas port 1. In the gas port status section of the display, confirm that the probe type is identified as 'L' (For more details, see the Changing the Actively Sampled Gas Port section.)

If using the Small Roaming (SR) probe, ensure the gas port is configured for this probe, and that 'S' appears in the gas port status section.

Step 2: Close the analyser display flap.

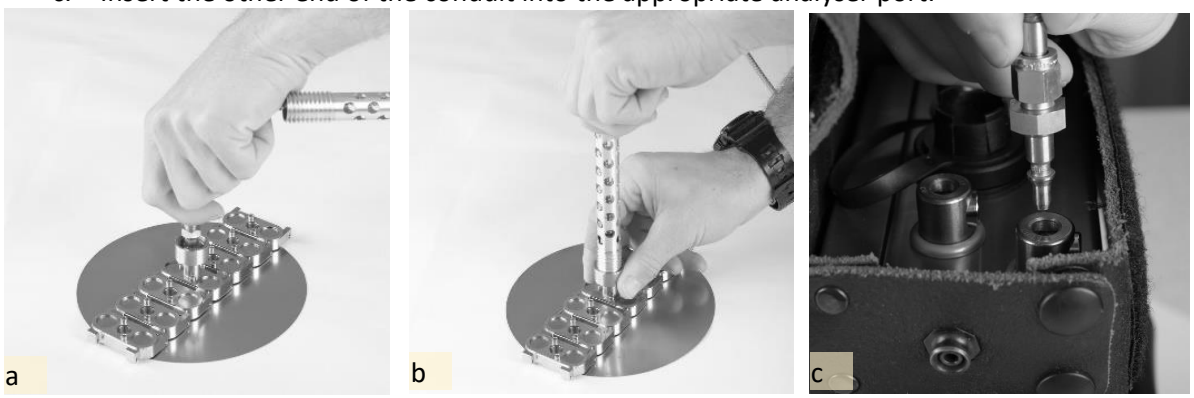
Step 3: Ensure the kit includes at least one 1 m conduit, both LR and SR flux probes. It is also recommended to bring marker pens (for identifying flux measurement sites), a notepad for recording flux measurements and a wire brush may also be useful for removing loose paint or rust.

Step 4: Place your arms 'through the carry straps of the leather case. While the case provides significant protection, adjust the cotton straps to ensure a secure and comfortable fit. The analyser should sit stably and not swing during transport to avoid collisions with cages, gantries, or stanchions.

Step 5: Upon arrival on site, retrieve and assemble the required probe and conduit. Connect the free Staubli end of the conduit to the analyser as shown in the sequence's images a to c in the LR or SR probe on-site assembly below depending on which you plan to use.
Step 6: Position the analyser so that the display is visible without using your hands.
Step 7: Check that the analyser reading is zero or near zero (≤ 3 pL/cm²/s). If necessary, re-zero by pressing the on/off key twice.

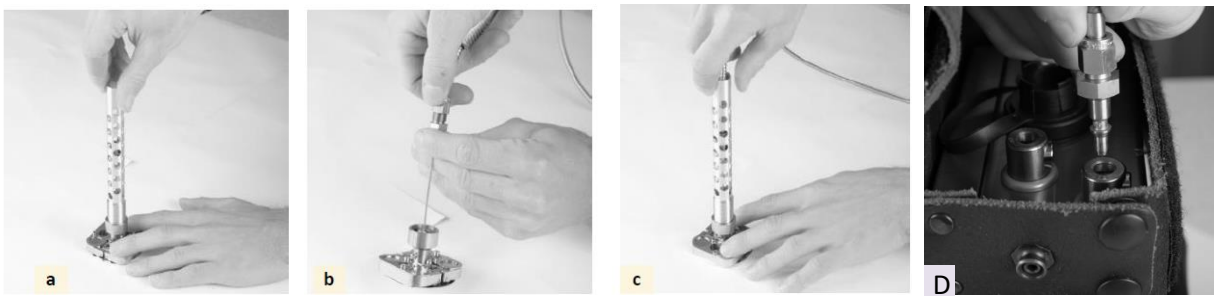
LR Probe On-Site Assembly

a. Push the screw-fitting end of the conduit through the probe handle and manually screw it into the probe assembly.
b. Screw the probe handle into the central probe plinth.
c. Insert the other end of the conduit into the appropriate analyser port.



SR Probe On-Site Assembly

a. Unscrew handle from probe and push threaded end of conduit through it.
b. Screw conduit nut manually onto SR probe capillary nut.
c. Screw handle into central probe plinth.
d. Insert the other end of the conduit into the appropriate analyser port.



Step 8: Identify a suitable flux measurement site (refer to the Hydrosteel Application Manual section on Appropriate Sites for Flux Measurement).
Step 9: Confirm that the steel temperature is below 350 °C (660 °F), as higher temperatures will damage the probe. The steel temperature is critical for evaluating flux measurements and should be recorded at this stage unless it is available from process data. Demarcate the site if necessary.
Step 10: Take a background hydrogen reading. Observe the instrument reading for at least one minute (this can be done intermittently during Step 8). Record the maximum displayed background reading X.

Step 11: Engage the probe. Position the LR or SR probe against the steel surface. The probe's magnetic segments should be aligned with the longitudinal axis of the steel under test. Attach the probe so that all magnets engage the collector plate simultaneously, rather than edge-first.
Step 12: Visually inspect the probe to ensure intimate contact, especially at the extremes of probe plate deformation. If the probe is not positioned correctly, remove it (see Step 13) and repeat this step.
Step 13: Record the attached probe reading. After one minute, note the displayed reading Y. The flux is calculated as Y - X.
Step 14: Remove the probe as instructed and move to the next measurement site, repeating from Step 11.
Step 15: Once the survey is complete, turn off the instrument, repack probes and conduits, and return all equipment to the workshop. Ensure the kit is clean and dry before storage.

NOTE: The effectiveness of Hydrosteel in registering flux depends on the probe forming a tight seal with the steel surface. Ensure there are no deep grooves or ridges across the test area, as these may affect the seal. In some cases, the suitability of the surface geometry can only be determined by attaching the probe.

CAUTION: Temperature above 350 °C (660 °F), can damage the probe. Ensure steel temperature is below this before attaching the probes.

CAUTION: Never drag the probe across the steel surface as this can cause damage to the collector plate/ probe.

Special considerations on using roaming probes to measure high temperature corrosion

If you are planning to engage the roaming probes to detect hydrogen flux from high temperature surfaces, consider the need for:

- Thermally insulating gloves
- High temperature crayons to demarcate new measurement sites
- A wire brush for removal of loose rust

Despite extensive lagging, the ambient temperature in the vicinity of high temperature equipment may be sufficiently elevated to cause the Hydrosteel analyser to temporarily register a shift in baseline measurement. The baseline recovers in about 5 to 15 minutes as the analyser temperature equilibrates. To minimise this effect, prevent the analyser being exposed to direct radiation from large expanses of unlagged equipment.

On attachment of a roaming probe to a hot test surface, flux is often seen to peak, decrease, then increase again to a steady value over the course of a few minutes, particularly if the probe has not already been heated during measurements nearby. This relates to the steel surface cooling on contact of the roaming probe, causing a temporary suppression of hydrogen flux, which recovers as the surface and the probe are heated by the wider steel bulk.

NOTE: The probe reading should be noted only after the flux reading has stabilised.

WARNING: On removing the probe from a hot test surface, care should be taken as the collector plate and adjoining components will be at a temperature approaching that of the steel surface.

WARNING: Allow appropriate time for the probe to cool down after it has been engaged on hot surfaces, continue to wear thermally insulated gloves on handling the probe to avoid injury.

CAUTION: Avoid probe contact with plastics. This can result in the plastic melting on the probe, giving rise to a false flux reading when the probe is next used (due to thermal degradation of plastics to give hydrogen).

CAUTION: Special attention is needed when using the LR or SR probe on high temperature surfaces. The effectiveness of Hydrosteel in registering flux depends upon intimate engagement between the probe and test steel surface. Through an inspection port this contact cannot be seen. Therefore, prior to measurement, ensure a clear path to enable the probe to be inserted without trapping shreds of rock wool or other detritus. Confirm there are no deep grooves or ridges running across the test area. Check site surface is free from loose rust. If necessary, remove detritus using the wire brush.

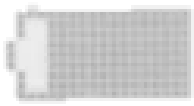
Battery Information

About the Battery

The Hydrosteel 6500 has an internal, 8000 mAh Lithium-ion rechargeable battery, which currently provide the best performance for your device. These batteries are lighter, charge faster, last longer and have a higher power density for more battery life compared to traditional batteries. The Hydrosteel will last about 70 hr accumulated operation hours from a fully charged battery.

About Charging the Battery

The battery icon in the top-right corner shows the battery level or charging status. All bars lit up in the battery icon show it's fully charged. As the battery discharges these bars will indicate the battery life left.

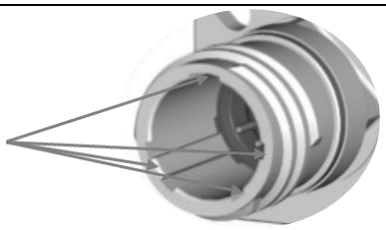
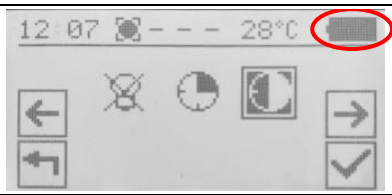


Battery life refers to how long your instrument operates before needing a recharge. It depends on several factors, including usage frequency, sensor warm-up time after wake-up, and environmental conditions. When the battery is low, the icon will flash, indicating that the instrument should be recharged as soon as possible.

If the battery is extremely low, you may have to charge it for several minutes before you can use the instrument again.

Charging the Battery

WARNING: The Hydrosteel battery must only be recharged in a non-hazardous area using the provided Hydrosteel 6500 charger (10V, 0.5A, part number A-6500103), which is included in the kit.

Description	Image
1. Connect Hydrosteel to a power outlet using the charging cable and provided Hydrosteel 6500 charger.	
2. The connection requires alignment of connector notches.	
3. Connect the charger to the battery charge port.	
4. Screw in the connector outer shell until the red check line is not visible. 5. Supply power to the battery charger. The instrument will self-power up after 10 s. 6. The battery icon will indicate the level of charge	
7. The batteries fully charge from empty within 16 hr. 8. When the battery is fully charged, battery icon in the top-right corner will show solid bars on the battery symbol.	

WARNING: If you suspect there may be liquid in the charging port of Hydrosteel, don't plug the charging cable into it.

Optimising the Battery Life

- If being stored without use, charge the device every two months to ~80%
- If used regularly, charge the device every week.
- For daily use, charge the device when battery level is below 30%.
- It is recommended to store the device within -10 °C to +45 °C.

NOTE: The battery has limited recharge cycles and may eventually need to be replaced. Battery life and charge cycles vary by use and settings. If you find yourself charging your device more frequently, it might be time for a new battery. The batteries should be serviced by ION Science or an authorised service provider, do not disassemble the device. See the service contact section at the end of the user guide for more details.

Calibration

Accurate Hydrosteel flux measurement is dependent on three system characteristics:

- The engagement of an undamaged probe
- Sample gas flow rate
- Calibrated hydrogen sensor response

Probe damage is addressed in *Routine maintenance*. Sample gas flow is automatically adjusted by the analyser: in the event of blockage, please see *Troubleshooting.*

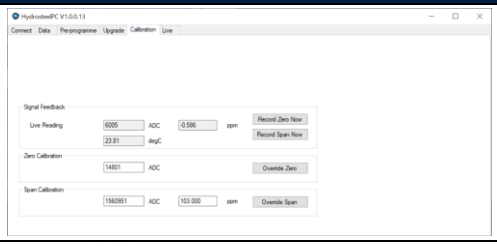
Sensor response is not prone to variation but may fail over many months of use, particularly if the sensor is exposed to temperatures exceeding 50 °C. In most cases, the sensor responsivity to hydrogen decays over extended times, but with appropriate storage it may retained for two years or more.

To assess the need for calibration, it is strongly recommended that the instrument be bump tested first. It is in any case, important to confirm all components necessary for calibration are present and correct, including adequate span gas, before proceeding with calibration.

NOTE: Only authorised and qualified persons should calibrate the Hydrosteel analyser, using all normal safety practices.

Calibration Setup

To carry out the bump test you require:

Item	Image
1. A PC with Hydrosteel PC software installed and enabled	
2. USB-B TO USB A cable (part number 861230)	
3. The Hydrosteel 6500 instrument to be calibrated	
4. A span gas cylinder of 100 ppm hydrogen in balance artificial air containing at least 4 bar test gas.	
5. Fixed flow rate regulator (60 mL/min)	
6. Calibration adaptor to connect the regulator to the Hydrosteel 6500 1 m conduit	
7. Hydrosteel 1 m conduit	
8. Clean flat work surface	

Calibration Procedure

Step 1 Place analyser on the flat work surface in an environment known to be remote from any source of hydrogen. Such sources of hydrogen are rarely encountered but may for example be an open window near to hydrogen processing equipment.

Step 2. Attach 1 m conduit to the analyser gas port 1. Turn the instrument on and ensure the device is configured to sample from gas port 1.

Step 3. Attach the fixed flow regulator adaptor (item 5) to the gas cylinder outlet and turn on.

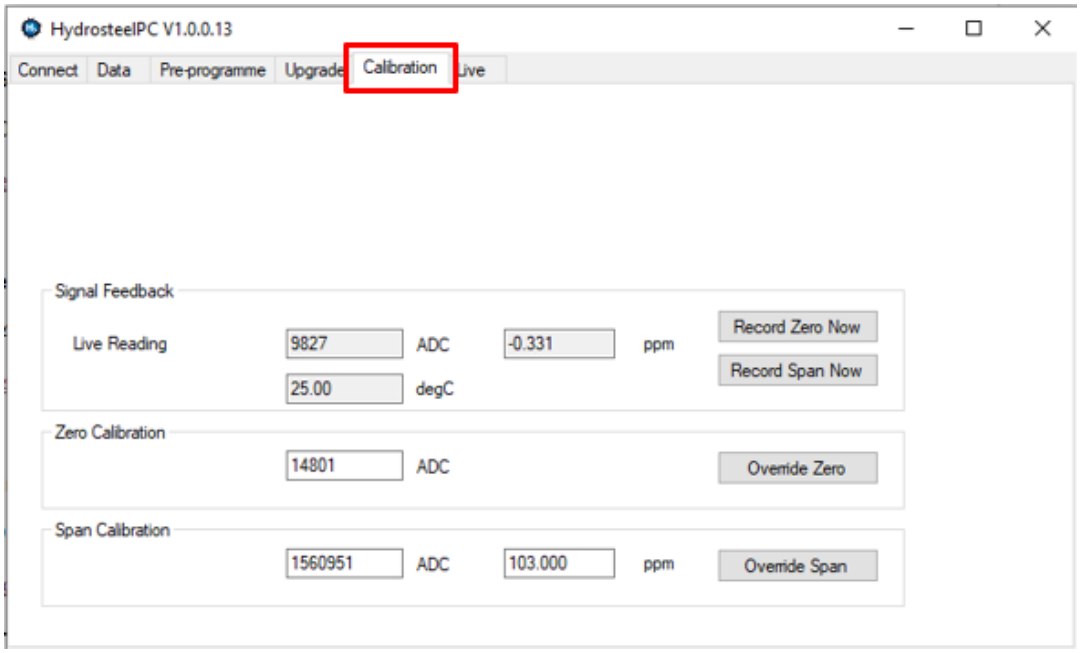
Step 4. Turn the cylinder on to confirm at least 0.5 bar of hydrogen pressure is available.

Step 5. Position the span gas cylinder (item 4) on its side on the flat work surface, near to the Hydrosteel 6500 instrument to be checked.

Step 6. Connect the instrument to your PC and the Hydrosteel instrument using the USB B cable provided.

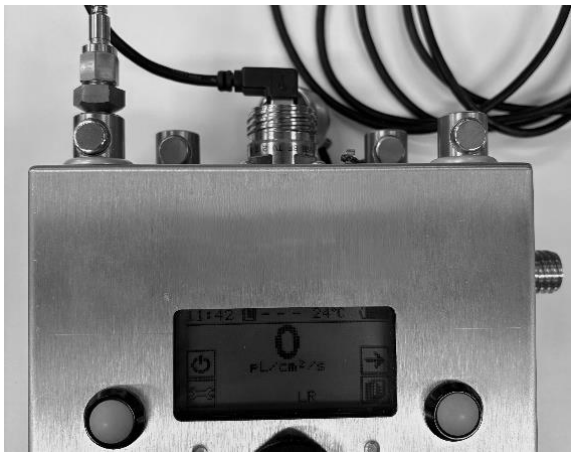
Step 7. Run Hydrosteel PC software. Press 'connect'.

Step 8. Select from the tab menu 'Calibration'.



Step 9. When the ADC measurement indicated has stabilised (usually within 1 minute of when it was turned on: the zero should generally settle to within ±0.5 ppm), press 'Record Zero Now'.

Step 10. Connect the open end of the 1 metre conduit to the calibration adaptor at gas port position '1' as indicated in the image below:



Step 11. Allow 2 min for the reading to be fully established. During this time, input the span gas hydrogen concentration in ppm. Press 'Record span now'.

Step 12. Remove the instrument from the calibration gas cylinder and turn the analyser gas off.

Step 13. Remove the PC connection and restart the analyser.

Step 14. Assign the active (sample) port to the LR probe. If the reading (in pL/cm2/s) varies over short time scales by more than ±1 pL/cm2/s repeat the calibration, having re- checking that all connections have been made securely, that there is sufficient gas pressure in the gas bottle and that the instrument was zeroed in air free from any hydrogen background.

Routine Maintenance

Cleaning

Clean the analyser and equipment using a damp cloth and mild detergent. Care must be taken around the analyser inlet and all pneumatic openings (sample tube etc.) to ensure that water does not enter. Dry immediately with suitable towel.

CAUTION: Organic solvents such as IPA should not be used to clean the analyser or collector plates. The solvent vapour in strong concentrations may affect the sensor readings.

The magnets may with time attract magnetic and ferromagnetic particles. These can easily be removed using an air jet from a typical air supply (100 psi / 7 bar). Simply play the jet across the surface wiping where necessary to blow the particles away.

Attention must be made to keep the following areas clean:

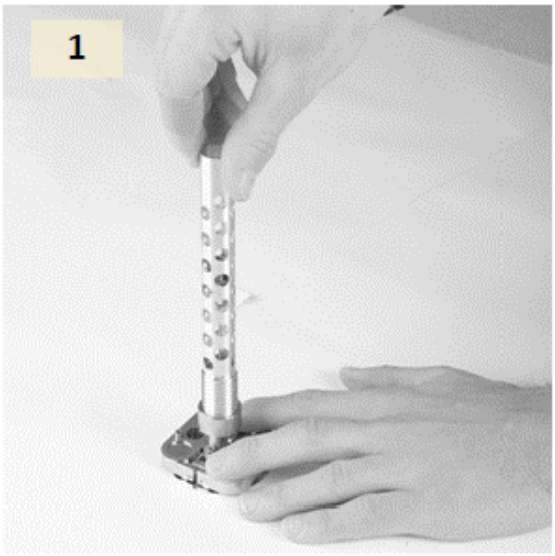
- All pneumatic joints
- Analyser inlet.
- Surface of collector plates.

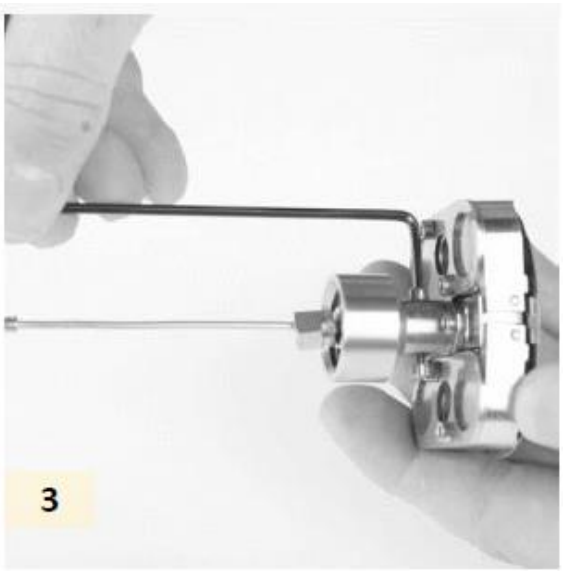
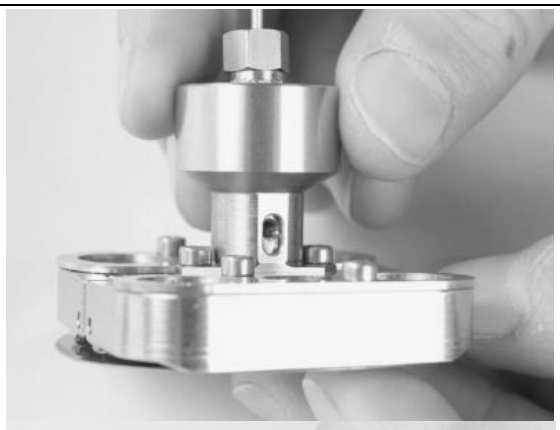
Underside of probe plates, to be free from metal filings that may be collected by magnetic attraction.

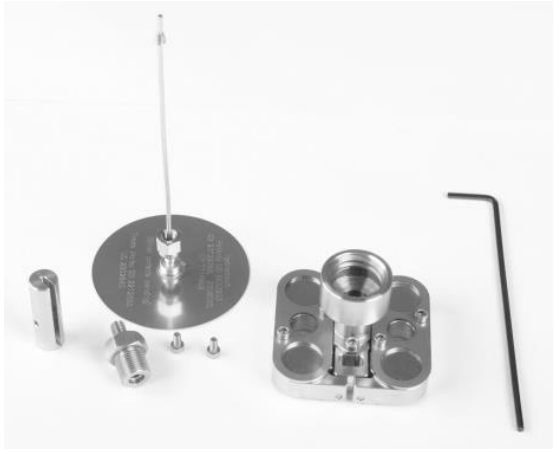
In the event of the analyser requiring repairs or service, the analyser should be returned to an approved service centre as identified at the end of this manual.

SR Probe Plate Replacement

The SR probe plate should be replaced when it becomes severely ridged or dented as this will affect the efficiency with which hydrogen is collected by the probe.

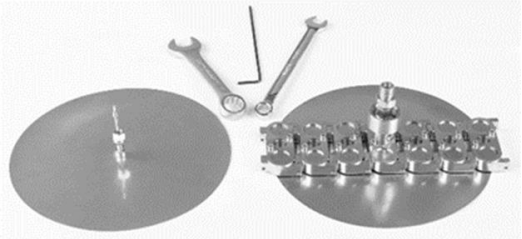
Description	Image
1. To change the SR probe, you will need the small and large (8 mm and 11 mm) spanner along with the 2 mm Allen key, and the spare SR probe plate that are all provide with the instrument.	
2. Remove the Roaming probe handle if fitted 3. Remove the conduit if fitted	
4. Using the two spanners, engage and unscrew the collector plate conduit adaptor from the probe assembly as shown.	

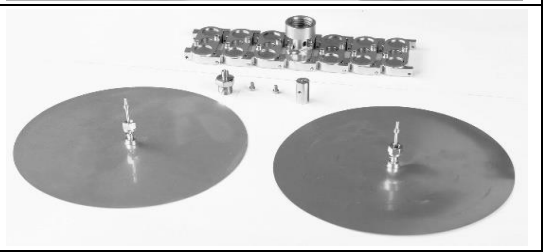
5. Next, using the Allen key, remove the probe handle adaptor by removing the two side screws as illustrated.	
6. The probe handle adaptor is not separated from the assembly. Instead, the magnetic assembly connected to the adaptor, should now be released from the old collector plate. Place the magnetic assembly to one side. The magnets are powerful, and care should be taken to avoid them picking up ferrous metals.	 

7. Unscrew the collector plate plinth from the old probe plate.	
8. You will now have completely dismantled the SR probe as illustrated. To reassemble the probe, carry out the exact reverse of procedural steps 1 to 5.	
9. Screw the replacement collector plate into the collector plate plinth (see step 5 above).	
10. Ensure the magnetic assembly has not picked up any ferrous detritus. Place the magnetic assembly over the collector plate plinth (see step 4 above). 11. Ensure the assembly is fully engaged, then insert the probe handle adaptor over the collector plate plinth. 12. Using the Allen key, screw in the two side screws to secure the adaptor against the collector plate plinth (see step 3 above). 13. Using the two spanners, attach the collector plate conduit adaptor to the collector plate terminal nut (See step 2 above). 14. Reattach the probe handle (See step 1 above). 15. The SR collector assembly is complete. Ensure the plate is protected when not in use.	

LR Probe Plate Replacement

The LR probe plate should be replaced when it becomes severely ridged or dented as that will affect the efficiency with which hydrogen is collected by the probe.

Description	Image
To change the LR probe, you will need the small and large (8 mm and 11 mm) spanner along with the 2 mm Allen key, and the spare LR probe plate that are all provide with the instrument. 1. Remove the Roaming probe handle if fitted 2. Remove the conduit if fitted	
3. Using the two spanners, engage and unscrew the collector plate conduit adaptor from the probe assembly as shown	
4. Using the 2 mm Alan Key unscrew the collector plate conduit adaptor from the probe assembly as shown	
5. Lift the entire ‘caterpillar’ assembly of magnets from the old probe plate as shown. 6. Place the magnetic assembly to one side. The magnets are powerful, and care should be taken to avoid them picking up ferrous metals.	

7. Unscrew the collector plate plinth from the old probe plate.	
8. Remove the plinth from the base by pulling it away from the extension spring on the collector plate and twisting it free.	
9. You will now have completely dismantled the LR probe, as illustrated. To reassemble the probe, carry out the exact reverse of procedural steps 4 to 9.	
10. Attach the collector plate plinth to the new collector plate by pushing the unthreaded end down against the extension spring on the collector plate (see step 9). 11. Ensure the plinth is central and snug against the plate capillary, then screw the plinth to the collector plate (see step 8). 12. Ensure the magnetic assembly has not picked up any ferrous detritus. 13. Place the magnetic assembly over the collector plate plinth (see step 6). 14. Ensure the assembly is fully engaged, then insert the probe handle adaptor over the collector plate plinth. 15. Using the Allen key, screw in the two side screws to secure the adaptor against the collector plate capillary (see 5 above). 16. Finally, using the two spanners, attach the collector plate conduit adaptor to the collector plate terminal nut (See step 4 above). 17. The LR collector's assembly is complete. Ensure the plate is protected when not in use.	

Instrument Warranty and Service

Warranty

Standard Warranty can be extended to up to 2 years on the Hydrosteel 6500 when registering your instrument via our website: https://www.ionscience.com/gas-and-leak-detectors/customer-support/register-your-instrument/

To receive your Extended Warranty, you need to register within one month of purchase (Terms and Conditions apply). You will then receive a confirmation email that your Extended Warranty Period has been activated and processed.

Service

At Ion Science we recommend that all our gas detection instruments be returned for service and factory calibration once every 12 months.

NOTE: the instrument's rechargeable batteries should not commonly require replacement during the lifetime of the product. If they do, they should only be replaced at an approved service centre in a safe environment.

For service requirements for ION Science contact:

ION Science Ltd
The Hive, Butts Lane
Fowlmere, Royston, SG8 7SL, UK
Tel: +44 (0) 1763 208 503

WARNING: DO NOT remove the battery cells before shipping this instrument. The Hydrosteel can only be shipped via land or sea freight with the Lithium-ion batteries installed. Faulty battery modules MUST NOT be shipped to ION Science or anywhere else.

WARNING: IATA regulations, the unit should be left on and discharged to one bar of charge which is less than 30%.

When an instrument requires recalibration, or in the event of a repair being necessary, a Returns Authorisation (RA) number must first be obtained from one of the addresses shown above. The following information is to be provided to enable the Service Department to prepare in advance for receipt of your instrument and to provide the best possible service to you:

1. Model (for example, Hydrosteel 6500).
2. Serial number (found on the display in the system/about menu, on the instrument label or on the calibration certificate).
3. Reason for return (for example, calibration required, or repair).
4. Details of the fault if the instrument is to be repaired.
5. Make a note of the RA number. A returns label can be emailed or faxed to you if required.
6. Pack the instrument carefully to prevent damage in transit. Use the original carry case if possible.

7. Before the instrument is sent to ION Science, freight paid, make sure that the returns label is attached or that the RA number is clearly marked on the outside of the package and on any correspondence.
8. Copies of the original purchase invoice and packing note should be sent simultaneously by airmail to expedite clearance through customs.
9. In the case of instruments which require repair outside the warranty period, an immediate quotation can be provided when obtaining the RA number.

Hydrosteel 6500 Specifications

Specification	Detail		
T90	< 85 Seconds		
Full range	0-2500 pL/cm^2/s.		
Resolution	< 2 pL/cm^2/s hydrogen emanating from steel		
Linearity	Linear over full range		
Reproducibility	5% or 1 pL/cm^2/s, whichever is greater.		
Rate of response			
%FSD	1%	50%	90%
27-inch (70 cm) conduit	8 s	25 s	60 s
78-inch (200 cm) conduit	17 s	35 s	75 s
Cross sensitivity (versus hydrogen = 100%):			
CO <1%; H_2S <20%; NO, <30%; C_2H_4, 80%			
Relative response (versus100 ppm @ 20 °C = 1.00):			
30 °C = 1.03; 40 °C =1.11; 50 °C =1.21			
Pre-set input flow rate	30 ±1 mL/min		
Background signal drift	< 50 pL/cm2/s equivalent per year, < 1 pL/cm2/s per hr. < 0.5 pL/cm2/s per °C		
Operating lifetime	Sensor, 1 year pump, > 1500 hr		

NOTE: Volumetric specifications are quoted at 20 °C and one atmosphere ambient pressure.

NOTE: Pre-set input flow, deploying 27-inch (70 cm) gas conduit and LT-R collector unless otherwise specified.

NOTE: 1 pL = 10^{-12} litres

Specification	Detail
Mechanical	
Gas fitting	Staubli® RBE3 conduit quick fit connection to instrument
Analyser dimensions	320 x 150 x 100 mm
Probe extension	15 cm high x 150 mm dia.
Collector	20 cm high x 150 mm dia.
Analyser weight	4.1 kg without leather case (4.45 kg with case)
Power requirements	
Batteries	2 x 4.8 Ahr internal Li-ion batteries at 3.8 V nominal to intrinsic safe design
Battery life	70 hr accumulated operation
Charger	100-240 VAC 50/60 Hz to 10 VDC
Energy management	Sleep mode, auto power off
Environmental	
Operating conditions	-10 °C to +50 °C (14 °F to 122 °F)
Storage temperature	-20 °C to 60 °C (4 °F to 140 °F)
Restricted temperature range during charging from Um: 253 V rms input	-20 °C to 45 °C (4 °F to 113 °F)
Operating Pressure Range	± 10 % ambient pressure
Operating Humidity Range	15 % RH to 90 % RH non- condensing
Ingress Protection	IP 54
Display	
Resolution	128 x 64 pixels
Light	Backlight with auto off setting
Type	LCD
Keypad	Panel mount IP rated buttons
Software	One single standard software version is required for each kit. All upgrades and data transfer achieved via USB connection and customer configuration via keypad or USB.
Communication	USB 2.0, enabling data transfer, programming and software updates.
Logging	Data log and monitoring frequency from 1 Hz to 1 reading / day, monitoring station sequence.
General specification	
Certification	Ⓔx II 1G Ex ia IIC T4 Ga
Ta	-20 °C ≤ Ta ≤ 60 °C

Warranty	1 year (standard) 2 years (extended)
EMC	EMC Directive 2014/30/EU
Calibration	Concentration: 100 ppm hydrogen, Flow: self-calibrating

Small Roaming Probe

Specification	Detail
Measurement type	Roaming probe
Maximum test surface temperature tolerance	350 °C (660 °F)
Resolution, pL/cm^2/s	10
Maximum range, pL/cm^2/s	20000
Collector diameter	54 mm, 2.25 in
Measurement surface (minimum test pipe diameter)	9 cm, 3.5 in
Collector efficiency	55 %

Large Roaming Probe

Specification	Detail
Measurement type	Roaming probe
Maximum test surface temperature tolerance	350 °C (660 °F)
Resolution, pL/cm^2/s	1
Maximum range, pL/cm^2/s	3500
Collector diameter	151 mm, 5.8 in
Measurement surface (minimum test pipe diameter)	12 cm, 5 in
Collector efficiency	85 %

Troubleshooting Guide

Error	Criteria	User Advice	Causes	Service Advice
Flow Errors:				
Line x blocked	Pabs > 20 mBar for 15 s	Ensure probe connected to inlet, press ↻	Nothing plugged in to inlet ports	
		Clear blockage, press ↻	Line blocked (water, rust?)	Test values for correct switching
		Try different conduit (i.e. unblocked one)		
		Try shorter conduit	Conduit too restrictive (>10m)	
	If only one line:	Return to service	Filter blocked	Replace filter
Low X low Pressure	Pabs <1 mBar for 60 s	Return to service	Pump fail - no pressure generated	Replace pump
			Piping disconnected upstream of pump	Verify all piping connected correctly
			Severe blockage of restrictor	Inspect and replace restrictor (and filters)
			Output port fully blocked	Inspect and replace tubing downstream of pump
Line x Flow fault	Flow error > 20% for 90 s	Return to service	Pump fail - max flow too low (leaky or valve)	
			Output port partially blocked	
Power-On Errors				
SD card	SD card failure	Return to service	SD card ejected	
			SD card failed	
Flow temperature sensor	No, I^2C comms with pump	Return to service	Cable loose, or electronics failure	Replace cable, or replace pump + sensor board
Pump control	No, I^2C comms with pump	Return to service	Cable loose, or electronics failure	Replace cable, or replace pump + sensor board
			Cable loose, or electronics failure	Replace cable, or replace pump + sensor board
Battery low	Battery low (Battery <5%)	Charge device (~3 days operational left)	Battery flat, or battery too cold	Charge the device
Battery flat	Battery flat (Battery <3.3V)	Charge device according to user manual	Battery flat, or battery too cold	Charge the device

Manual Log

Manual Version	Amendment	Issue Date	Instrument Firmware	PC Software
1.0	First Issue	15/10/2024	0.3.02	1.0.0.13
2.0	Updated images and description	05/03/2025	0.3.02	1.0.0.13

Disclaimer: Information in this manual is subject to change without notice and does not represent a commitment on the part of Ion Science. No claims, promises or guarantees are made about the accuracy, completeness, or adequacy of the information contained herein.

Quality Assurance

The Hydrosteel 6500 instruments are manufactured by ION Science Limited within an ISO 9001 compliant quality management system, which ensures that the equipment supplied to our customers has been designed and assembled reproducibly, and from traceable components.

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