

11 – Installation Report

Client:	Techcomp / Demo IRMS System		
Quotation Number:	19731	Date:	26/01/2026
Job Number:	IN1379	Date:	09/03/2026

Contact:	Biqi LYU - TechComp		
Date of Visit:	9 th – 22 nd September 2026	No. of Days:	10
Engineer:	David Harris		

Details of visit:

Arrived on site and inspected instruments.
 All units have been setup on desktop by TechComp engineers with initial installation work carried out.
 HS2022- functioning and pumped down.
 PyroEarth – Damage to HT furnace during transit to China. New HT furnace delivered and to be installed by Sercon engineer.
 µCarbs & DH VerSA – Installed but not tested.
 GC-CP & Orchid – On desktop but not installed.

HS2022

All comms to PC setup and running.
 All readbacks respond as expected – All OK.
 All valves respond - All OK.
 Flight tube pumped down . Turbo pump speed for both turbos 93k rpm – All OK.
 Vac pressure at approx. 3.4×10^{-9} mBar with all isolation valves closed.
 HT & Source active. Emissions = approx. 155µA with trap set to 50µA. – All OK.
 No issues noted with Head Amp, Gauges, isolation valves, solenoid valves – All OK.
 Background scans show no contamination – Pass
 eMag functioning with no issues – All OK.

During testing of GC-CP system issue found with new micro PCB firmware replating to saved events.
 Amount of available events from a single motherboard reduced. This affected the standard Ref Gas testing on GCCP method, as normal events exceed amount. Tests ran with reduced event numbers as a workaround.
 With further testing past events were not being forgotten from pervious save states (i.e. other set-up methods).
 This was causing events to trigger from pervious sample lists methods. As a work around events overwritten with null events to prevent undesirable events from triggering.
 Issue was located via dial in with Sercon software engineer. To resolve the issue the firmware will require to be re-flashed. Issue ongoing with Sercon. System controller may need to be returned to Sercon HQ for rework.

User does not have enough isolation valves for all Prep systems present with order to single HS2022. User will have to manually change lines between 2 systems for usage. User decided upon swapping between PyroEarth (combustion) line in and µCarbs line in. User in discussions to install manual 4 way change over switch for ease of use.

System tested with CO₂, N₂ & HD ref gas.
 During testing coincidence with HD ref gas noted to be poor. eMag moved as required.
 No instability noted during Ref Gas runs, however during testing of PyroEarth system spikes occurred during N₂ analysis.
 Ion source removed for inspection. No damaged to filament noted.
 All areas of source checked for damage – All OK.
 Several areas adjusted to ensure more distance between components.
 Focusing magnets adjusted to give more distance between Trap/Filament & HT voltages.
 Ion source refitted with new copper gasket. System pumped down with no issues.

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Filament fired with no issues. Emission approx. 145 with trap set to 50µA. – All OK.
 Slight sensitivity boost noted.
 Tuning readjusted as required. Ref Gas specs rerun as required – All pass.

Final Ref Gas spec results as follows.
 Ref. 5 second pulse
 Precision. n=5, 5 sec pulse.
 Linearity. n=6, 1, 2, 4, 6, 8, 10 sec pulses

N₂ Peak Shape (2/1) = Pass
N₂ Ref Gas Stability (2/1) = Pass

Ref Gas ¹⁵N Precision = 0.016‰ S.D.
Ref Gas ¹⁵N Linearity = 0.069‰ S.D.

CO₂ Peak Shape (2/1) = Pass
CO₂ Ref Gas Stability (2/1) = Pass
CO₂ Peak Shape (3/1) = Pass
CO₂ Ref Gas Stability (3/1) = Pass

Ref Gas ¹³C Precision = 0.026‰ S.D.
Ref Gas ¹³C Linearity = 0.090‰ S.D.
Ref Gas ¹⁸O Precision = 0.057‰ S.D.
Ref Gas ¹⁸O Linearity = 0.156‰ S.D.

CO (from CO₂ Ref Gas) Peak Shape (3/1) = Pass
CO (from CO₂ Ref Gas) Stability (3/1) = Pass

HD Peak Shape (2/1) = Pass
HD ref gas Stability (2/1) = Pass

Ref Gas HD Precision = 0.078‰ S.D.

PyroEarth

Unit damaged in transit. HT furnace to be replaced.
 Replacement furnace and heating element shipped from Sercon and onsite before engineer arrived.
 Unit powered off. Damaged furnace removed. Old element crack and snapped during removal process.
 Probably also damaged during delivery.
 New furnace and heating element fitted. Power supply connected & new thermocouple wired in.
 Unit powered on. All comms to PC present – All OK.
 All readbacks respond as normal – All OK.
 Pyrolysis tubes setup – All Flows OK.
 All valves respond as normal – All OK
 All furnaces/GC oven responds as expected. HT furnace holds at 1400°C with no issues – All OK.
 System setup in high mass mode for ¹⁸O pyrolysis mode for initial testing using aspartic acid. Results good.
 During sample testing of HD issue with carousel autosampler. Purge flow is blocked during opening of drop chute. Autosampler dismantled and cleaned X4 times to resolve issue. Issue not resolved.
 All other possible causes of blocking of leak occurring due to backpressure fully investigated. No issues found.
 Fault lies with autosampler.
 During further testing carousel also stopped turning. Part replaced by Sercon and shipped out during engineer's visit.
 New carousel autosampler has similar issue with purge flow being blocked during opening.
 Engineer was able to adjust part so that purge flow is reduced during opening so it can function, but leak required to be present to operate. The leak must be v. small as the PyroEarth passed the pressure test.
 However the setup is on a fine balance. Any natural turning of holding screws via usage will cause the balance to shift and the blocking issue to re-occur, or for the helium leak to become too large.
 TechComp also reports that the customer is not happy with style of autosampler claiming that it is not fit for purpose on a modern MS system. Sercon to follow up at future date to resolve issues.

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Due to time constraints with replacement parts shipping, and turnaround time to switch between high mass & low mass mode. HD pyrolysis testing could not take place.

Combustion mode setup for ^{15}N & ^{13}C analysis only. ^{34}S analysis not required at this time.
Standard N&C tubes made. Silver wool not available to user. Silver oxide used instead. Also standard magnesium perchlorate not available to user due to national restrictions on shipping. The customer is using their own material for water trap tubes. Unknown how this will affect results.

Background scans shows low levels of background materials - Pass
 N_2 blank peak below acceptance level (major beam $>5.0 \times 10^{-10}$) – Pass

During testing of PyroEarth system spikes occurred during N_2 analysis.
Ion source removed for inspection. No damage to filament noted.
All areas of source checked for damage – All OK.
Several areas adjusted to ensure more distance between components.
Focusing magnets adjusted to give more distance between Trap/Filament & HT voltages.
Ion source refitted with new copper gasket. System pumped down with no issues.
Filament fired with no issues. Emission approx. 145 with trap set to $50\mu\text{A}$. – All OK.
Slight sensitivity boost noted.
Tuning readjusted as required. Ref Gas specs rerun as required – All pass.

Overall system demonstrates low N_2 sensitivity. Isolation crimps adjusted to allow for maximum sample size.
 N_2 beam height approx. 5nA (N $100\mu\text{g}$).
 CO_2 beam height approx. 18nA (C $400\mu\text{g}$).

Bitmap altered as required to show correct valve numbers and flow pathways.

Combustion batch samples: AS BEET MIX liquid samples.
Precision batch range = N $100\mu\text{g}$, C $400\mu\text{g}$, $n=5$, results drift corrected.
Linearity batch range = N $10\text{--}200\mu\text{g}$, C $25\text{--}500\mu\text{g}$, $n=6$, results drift corrected.

Pyrolysis batch samples: Aspartic Acid liquid weighted samples.
Precision batch range = O $100\mu\text{g}$, H $200\mu\text{g}$ $n=5$, results drift corrected.

*Combustion ^{15}N Precision = 0.097% S.D.
Combustion ^{15}N Linearity = 0.116% S.D.*

*Combustion ^{13}C Precision = 0.033% S.D.
Combustion ^{13}C Linearity = 0.233% S.D.*

*Pyrolysis ^{18}O Precision = 0.177% S.D.
Pyrolysis HD Precision = N/A*

µCarbs & VerSA

System installed prior to engineer's visit by TechComp engineers.
All comms setup and responding as normal.
All valves respond as normal.
System had several batches run prior to Sercon engineer setup.

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Needle plumbed in backwards. Flows reversed through needle in/out flow. In/Out ports labelled backwards on unit. Sampling still possible with this configuration but backflushing may have been incorrect. Possible that air would still be trapped within sample vials. Correct orientation installed.

During sampling damage occurred to needle X2 Z depth lowered more than settings dictated. New needle sent from Sercon, but unfortunately due to an error from the manufacturer incorrect needle type sent. One of the damaged needle repaired by Sercon engineer to a point where sampling was possible for assessment. Needles need to be replaced by Sercon.

Heated block temps ran away during setting to 50°C. Block B raised to >150°C. This warped the plastic lid covering. Parts requires replacing to enable correct sample position.

Adjusting connections at PCB resolved run-away heating issue. Heated blocks both now respond as expected – Issue resolved.

EPC fail on flush gas line in. pressure runs away to max point (50PSI). High pressure results in leaking across holding valve (V4). System initially setup to flush with 100% CO₂ gas for water equilibration method. V4 leakage caused blank sample vial (Helium flushed) to become contaminated with CO₂ from cylinder.

PCB checks demonstrate that issue is with EPC unit, not prep EPC.

New EPC sent from Sercon HQ. Part replaced for new.

New EPC responds as normal - Issue resolved.

Bitmap altered as required to show correct valve numbers and flow pathways.

System tested using 2% H₂ in He, breath samples, and acid dosing carbonates method.

Breath samples from 6ml vials. n=5. Drift corrected.

2% H₂ in He samples from 6ml vials. n=4 (due to number of flushed samples available). Drift corrected.

N.B. due to time constrain a full acid dosing/carbonates method was not possible.

μCarbs (Breath samples) ¹³C Precision = 0.085‰ S.D.

μCarbs (2% H₂ samples) HD Precision = 0.206‰ S.D.

μCarbs (Acid dosed samples) = CO₂ present in all samples tested.

GC-CP & Orchid

New Dean Switch method to be setup within TechComp GC oven for switching out separated solvent from GC carrier flow to combustion furnace.

Experiments in flow rates and pressures required to ensure flow switching takes place and that breakout of samples between FID path and combustion tube path does not take place.

Plumbing within Orchid unit required to re-direct flows where required.

As a cause of the new setup, and GC unit not being able to be shipped to the UK due to local restriction, Orchid unit had not been able to be tested on Sercon Test Floor.

Loose connections present within unit, this resulted in large He leak. He cylinder required replacing due to depletion. Advise TechComp engineers to check for He leaks on all systems prior to fitting He lines to units, especially if other units within deliver had shown damage to components.

Leaking connection sealed.

Changeover valve located inside of GC oven. Valve wired into Orchid unit to be controlled via Callisto software. V12 now used as changeover valve in combination with V7.

HT furnace responds as expected – All OK.

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Combustion tube made up and installed. Conditioned in the presence of O₂ (approx. 5ml/min) into carrier flow at 600°C. Temp set to 860°C for analysis.

Pressure set to 2PSI.

Make up flow set to 1ml/min. Controllable at manual valve on front of Orchid unit.

V7 activates during FID switch. Flow approx. >1ml/min.

GC column flow set to 2ml/min.

Nafion drier installed with sweep flow of approx. 10ml/min.

Carrier line fitted to Isolation valve. Crimp adjusted to give highest beam response possible.

Techcomp installed own GC column for testing.

System tested using 3 alkane mix in hexane. Samples ran at 1µl injections 13:1 split for C analysis.

FID/combustion furnace switching works well with Dean Switch setup.

No breakout observed. Solvent all directed into FID channel.

Separation good on GC column between alkane samples. [decane (C₁₀H₂₂), dodecane (C₁₂H₂₆), and tetradecane (C₁₄H₃₀)].

Sample peaks approx. 1.5nA beam height. Beam height doubles as expected with 2µl sample size.

Other make up flows & pressure attempted during testing. System set to lowest possible pressure and flow to stop dilution effect upon samples.

Issue found with new micro PCB firmware relating to saved events.

Amount of available events from a single motherboard reduced. This affected the standard Ref Gas testing on GCCP method, as normal events exceed amount. Tests ran with reduced event numbers as a workaround.

With further testing past events were not being forgotten from previous save states (i.e. other set-up methods). This was causing events to trigger from previous sample lists methods. As a work around events overwritten with null events to prevent undesirable events from triggering.

Issue was located via dial in with Sercon software engineer. To resolve the issue the firmware will require to be re-flashed. Issue ongoing with Sercon. System controller may need to be returned to Sercon HQ for rework

With adjusted method events Ref Gas specs pass.

Precision (*multiple peaks method*) . n=5. samples = 2 sec pulse. Ref pulse = 2 sec.

Linearity (*multiple peaks method*). n=5. Samples = 1, 2, 5, 2, 1 sec pulses. Ref pulse = 6 sec.

3 Alkane Mix, [decane (C₁₀H₂₂), dodecane (C₁₂H₂₆), and tetradecane (C₁₄H₃₀)] 1µl injection, at 13:1 split, gives 100ng C on column.

Due to time constraints with replacement parts shipping, and turnaround time to switch between high mass & low mass mode. HD pyrolysis testing could not take place.

GC-CP (Ref Gas multiple peaks method) Single ¹³C Precision = 0.085‰ S.D.

GC-CP (Ref Gas multiple peaks method) Single ¹³C Linearity = 0.085‰ S.D.

GC-CP (3 Alkane mix) Single CO₂ separation = Pass

*GC-CP (3 Alkane mix) Single. Multiple samples Peak 1 [n=5] ¹³C Precision = 0.338‰ S.D. **

GC-CP (3 Alkane mix) Single. Multiple samples Peak 2 [n=5] ¹³C Precision = 0.150‰ S.D

GC-CP (3 Alkane mix) Single. Multiple samples Peak 3 [n=5] ¹³C Precision = 0.123‰ S.D

*N.B precision may be improved by altering events, or temp ramping times, to enable greater separation from Ref Gas pulses.

Training given in use of GC-CP software and reprocessing of data.

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Recommendations:

- Advise further method development with timings and events to optimise data.
- Advise continued talks with Sercon about known issues (see report for more details).
- HD tuning may need revisiting after Ion Source filament swap. Unable to check tuning due to time constraints.

Faults and Shortages:

See report for more details.

- System Controller micro PCB
- Needle damage
- µCarbs Flush EPC (resolved)
- Carousel Autosampler X2
- µCarbs heated blocks (resolved)
- Leaking Orchid (resolved)
- HTEA furnace (resolved)

Follow up:

TBC

Engineer: David Harris

Date: 23rd September 2026

Signed:

