K&A Labs Oligonucleotide Synthesizer

Service Manual

Software: KA Labs Version 0.0.16.6

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Revision History

Version	Date	Author	Description of Changes
v1.0	Apr 2026	H. Devoz	Split from user manual; added technical glossary and maintenance logs

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Table of Contents

How to Use This Manual

This Service Manual covers all maintenance, component replacement, and servicing procedures for the K&A Labs Oligonucleotide Synthesizer. It is designed for laboratory personnel who are responsible for keeping the instrument in good working order — no specialist service engineer is required for the procedures described here.

The K&A documentation set consists of two companion documents:

Document	Purpose
K&A Labs User Manual	Day-to-day operation: installation, software configuration, running syntheses, monitoring runs, post-processing, and basic troubleshooting.
K&A Labs Service Manual (this document)	Maintenance and servicing: compressor upkeep, membrane replacement, valve replacement, bottle cap changes, detailed troubleshooting, and service logs.

Where this manual refers you to the User Manual — for example for the Shutdown Procedure or Flow Rates calibration — those steps are part of normal software operation and are covered in full detail there. Keep both manuals accessible at the instrument.

> **NOTE**
> Always complete the full Shutdown Procedure (described in the User Manual) before beginning any maintenance procedure in this manual. Never begin servicing with pressurized lines.

1. Introduction

1.1 About This Manual

This Service Manual covers maintenance, servicing, and troubleshooting procedures for the K&A Labs Oligonucleotide Synthesizer. It is intended for laboratory personnel responsible for keeping the instrument in good working order.

For day-to-day operation of the synthesizer — including running syntheses, managing sequences, and using the software — refer to the K&A Labs User Manual.

1.2 Intended Audience

This manual is intended for:

- Laboratory personnel responsible for routine instrument maintenance
- Technicians performing component replacement (membranes, valves, bottle caps)
- Anyone responsible for compressor installation and upkeep

> **NOTE**
> Some procedures in this manual require working with pressurized systems, flammable chemicals, and sensitive electronic components. Always follow the safety guidelines in Section 2 before beginning any service procedure.

1.3 Instrument Identification

Record the instrument information below for future reference.

Instrument Model	
Serial Number	
Software Version	
Installation Date	

2. Safety

2.1 User Attention Words

Term	Meaning
NOTE	Useful information that improves understanding or performance
IMPORTANT	Information required for proper instrument operation
CAUTION	Risk of minor or moderate injury if precaution is not taken
WARNING	Risk of serious injury or death if warning is not heeded
DANGER	Immediate risk of serious injury or death

2.2 Chemical Hazard

⚠ WARNING

Some chemicals used with the K&A instrument are potentially flammable. Read and understand all MSDSs before handling any chemicals. Wear appropriate PPE at all times: safety glasses, gloves, and a lab coat. Use only in a well-ventilated area or fume hood. Comply with all applicable regulations for chemical storage, handling, and disposal.

2.3 System Pressurization

⚠ WARNING

Always depressurize the system fully before disconnecting any tubing, fittings, or components. Never turn off the high-pressure air supply while reagent or amidite bottles remain pressurized. Always depressurize bottles first by loosening their caps before closing the high-pressure supply.

2.4 Before Operating the Instrument

Ensure that everyone involved with instrument operation has:

- Received instruction in general laboratory safety practices
- Received instrument-specific safety training
- Read and understood all relevant MSDSs

2.5 Laboratory Requirements

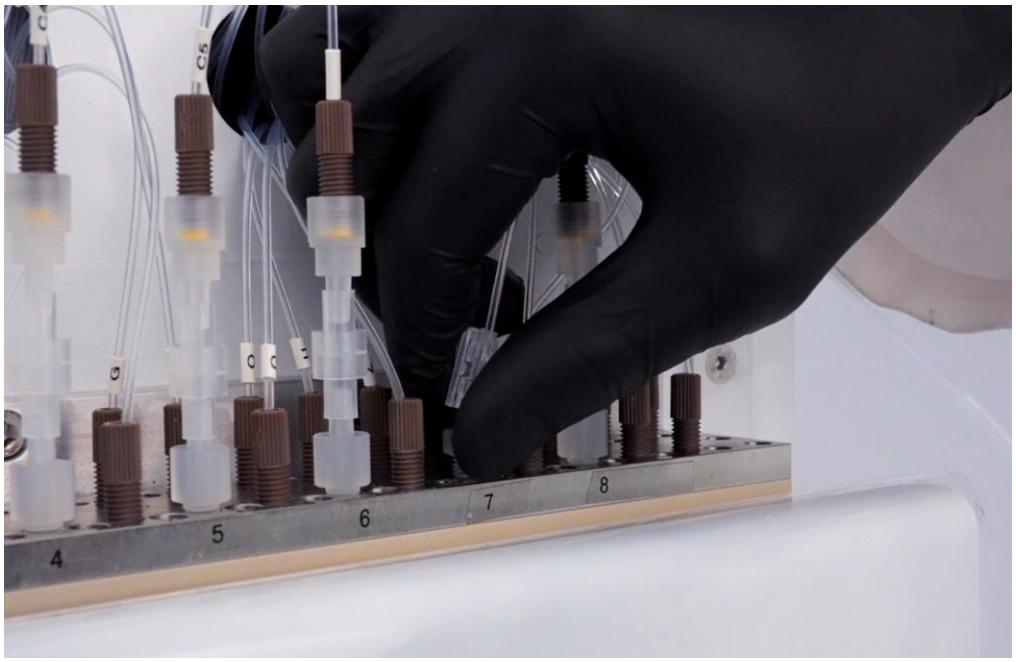
Parameter	Requirement

Temperature	16–22°C (operational range 10–40°C)
Humidity	Up to 99%
Altitude	< 2000 m
Power	120–240 VAC, 50/60 Hz
Gas — High Pressure	Compressed air, oil- and water-free; 65–80 psi (0.45–0.55 MPa)
Gas — Low Pressure	Argon (99.99%); 30–40 psi (0.21–0.28 MPa)
Environment	Non-conductive pollutants only

3. System Overview

3.1 System Description

The K&A Synthesizer performs stepwise nucleotide coupling to produce oligonucleotides linked to a solid support. The system is fully pressure-driven — there are no internal liquid pumps or motors.



Accessing the column manifold. Synthesis columns install at the numbered positions along the support block.

3.2 System Architecture

Fluidics

Manages reagent delivery from pressurized bottles through the valve manifold to the synthesis columns and waste system.

Pneumatics

Argon gas at low pressure drives fluid movement. Compressed air at higher pressure actuates the pneumatic valves that control the sealing membrane.

Electronics

Controls valve actuation, communicates with the KA Labs software, and interfaces with the trityl monitor sensor.

3.3 Major Components

Component	Function
Pneumatic Valves	Control fluid routing through the manifold
Pressure Regulators	Maintain correct gas pressure for fluid delivery and pneumatic control circuits
Pressure Ball Valves	Manual valves used to open and close the argon supply to bottle groups
Bottle Caps	Sealed caps that pressurize reagent and amidite bottles and route fluid to the manifold
Sealing Membrane	Flexible membrane that controls fluid flow. Replaced every 4 months.
Main Block	Central manifold block routing reagent and amidite delivery to synthesis columns
Synthesis Columns	Reaction vessels where oligonucleotide coupling occurs
Trityl Monitor	Optical sensor measuring coupling efficiency at 470 nm
Waste Manifolds	Tubing network routing waste fluids away from the columns
Waste Container	Collects waste fluids generated during synthesis
Air Compressor	Supplies compressed air to actuate pneumatic valves

3.4 Membrane Operation

The K&A synthesizer uses a flexible membrane valve system. Reagents flow toward the membrane but cannot enter the manifold while the membrane is held closed by compressed air. When a pneumatic valve activates, the compressed air on that channel is temporarily released, allowing the reagent to push the membrane open and flow into the manifold. When the valve closes, the membrane reseals.

3.5 Key Operating Specifications

Parameter	Value
Maximum Power	~240 W
Recommended Low-Pressure Setting	0.04 – 0.07 MPa (argon)
Recommended High-Pressure Setting	0.30 – 0.40 MPa (compressed air)
Fluid Control	Pneumatic membrane valve system
Trityl Detection Wavelength	470 nm
Fuse	3.15 A (slow)

4. Maintenance Schedule

Routine maintenance is required to ensure reliable fluid delivery, stable pressure control, and consistent synthesis performance. Completing maintenance on schedule helps prevent instrument downtime and extends the service life of consumable components.

> **NOTE**
> Tasks marked 'As Needed' should also be performed any time a related issue is suspected, regardless of whether the scheduled interval has been reached.

4.1 Weekly Tasks

#	Task	Reference
1	Purge the air compressor regulator and particle filter of accumulated water	Section 5
2	Purge the compressor water reservoir	Section 5
3	Clean all reagent and amidite bottle caps; inspect for wear or damage	—
4	Inspect all waste tubing and waste container; empty waste container if needed	—
5	Visually inspect all tubing and fittings for signs of leaks, kinks, or wear	—

4.2 Monthly Tasks

#	Task	Reference
1	Record flow rates for all reagent and amidite lines	See User Manual — Flow Rates
2	Compare current flow rate values to historical data; investigate any significant discrepancies	See User Manual — Flow Rates
3	Clean all column luer lock adapters	—
4	Inspect all gas line connections and fittings for leaks or loosening	—
5	Verify pressure gauge readings are within specified operating ranges	—

4.3 Every 4 Months

#	Task	Reference
1	Replace the main valve block membrane (40-port)	Section 6

2	Inspect all luer-lock fittings and reagent/amidite line connections for wear	—
3	Back up the K&A database using the Backup/Restore function	See User Manual — Backup/Restore
4	Review synthesis log history for recurring errors or yield trends	—

4.4 As Needed

Task	Trigger
Replace upper valve block membrane (5×3)	No flow through one or more column positions
Replace a pneumatic valve	Persistent flow failure on a specific line not resolved by membrane replacement
Change a bottle cap	Cap or O-ring is damaged, cracked, or leaking
Check flow rates outside the monthly schedule	Estimate Volume results appear inaccurate; a specific line is suspected of under- or over-delivering
Re-prime all lines	After any extended idle period, after replacing reagents or amidites, or before any critical synthesis run

5. Compressor Maintenance

5.1 Overview

Regular purging and inspection of the air compressor are required to maintain clean, dry pneumatic air and ensure reliable instrument performance. This procedure removes accumulated moisture, verifies proper pressure operation, and checks compressor oil and filtration components.

Required Tools and Supplies

- Lint-free wipes
- Compressor oil (manufacturer-approved or equivalent)
- Crescent wrench
- Allen wrench (if needed for filter assembly)
- Maintenance log

> **⚠ WARNING**
> Always power off and depressurize the compressor before performing maintenance. Never turn off compressor pressure while reagent or amidite bottles are still pressurized. Always complete the full Shutdown Procedure (see User Manual — Shutdown Procedure) before proceeding.

> **⚠ CAUTION**
> Do not overfill compressor oil. Oil should not exceed the midpoint of the sight glass. Discolored or contaminated water (orange, brown, or sludgy) may indicate internal compressor damage and should be reported.

5.2 Procedure

Step 1. Verify Operating Pressure

Before shutdown, observe and record the pressure readings:

- Instrument regulator: 0.30 – 0.40 MPa (44–58 psi)
- Compressor output: 0.45 –0.55 MPa (65–80 psi)

The compressor must always supply higher pressure than the instrument regulator. If compressor pressure is lower than instrument pressure, the system may behave as if there is a leak.

Figure 5-1: Verify compressor pressure readings

Step 2. Perform System Shutdown

- In the software, navigate to Manual Control.
- Run the full Shutdown Sequence.
- Confirm all reagents have returned to their bottles, liquid and waste lines are empty, and all bottles are depressurized.
- Close the Argon supply and Compressor (high-pressure) supply valves.

> **⚠ WARNING**
> Failure to properly depressurize the system may result in cross-contamination of reagents.

Step 3. Power Down and Depressurize Compressor

- Turn off the compressor using the main power switch.
- If needed, open the manual vent valve to release residual pressure.

Step 4. Drain Water from System

- Locate the water trap drain valve.

- Place a container beneath the outlet tube.
- Slowly open the valve and allow accumulated water to drain.
- Close the valve once fully drained.

⚠ CAUTION

If brown/orange liquid is being drained from the reservoir, consider replacing your compressor. This is a sign of rust and corrosion inside the reservoir which could contaminate the flow pathway.

Step 5. Check Oil Level

Locate the compressor oil sight glass. Oil level should be at the midpoint of the indicator. If below midpoint, proceed to Step 6.

Step 6. Add Oil (If Required)

- Remove the oil cap.
- Slowly add compressor oil.
- Monitor the sight glass.
- Stop when oil reaches the midpoint.

> **⚠ CAUTION**
> Do not overfill. Excess oil can damage the compressor.

Step 7. Inspect Filter and Tubing

- Inspect air filter for discoloration or contamination. Normal: white or green. Replace if darkened or damaged.
- Inspect tubing for kinks, blockages, or oil or particulate contamination.
- Replace compressor and lines if filter is constantly becoming discolored.

Step 8. Record Maintenance

Record the following in the maintenance log (Appendix C):

- Compressor pressure readings
- Oil level
- Water condition
- Filter condition
- Any observed issues

Report any abnormalities to Sierra BioSystems support.

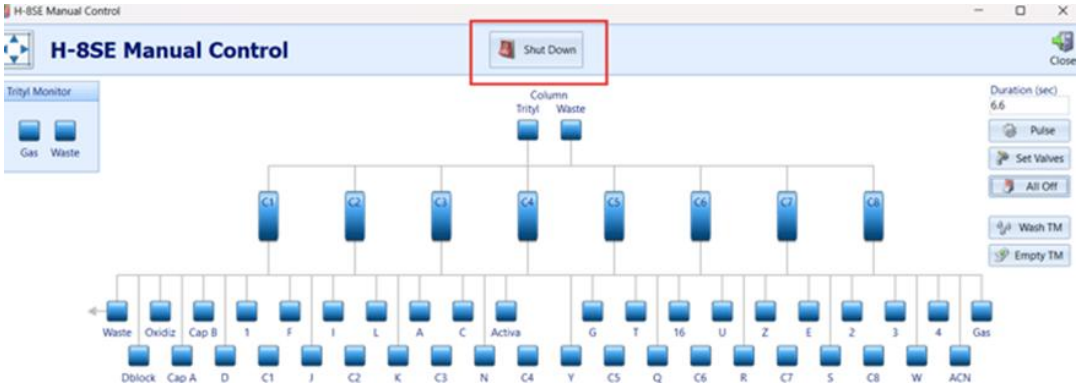
6. Membrane Replacement

> **NOTE**
> Because of the time required to shut down and disassemble the valve block, membrane replacement is most efficiently performed at the same time as pneumatic valve replacement (Section 7).

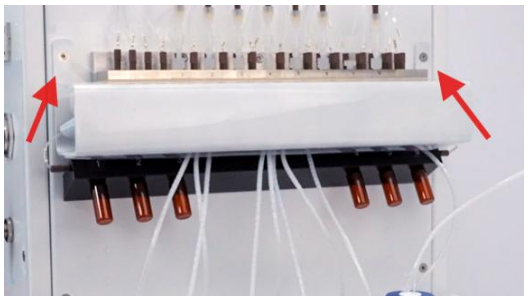
Frequency: Main Block — every 4 months or as needed. Upper Blocks — once a year or as needed.

6.1 Shut Down and Prepare

- Ensure the instrument has completed the full shutdown procedure and all pressure gauges read zero before beginning.



- Close both high(compressor)- and low(argon)-pressure switches after shutdown completion
- Remove the protective plate covering the valves by unscrewing its two screws.



- Disconnect all reagent, amidite, and column luer-lock fittings.

6.2 Disassemble and Clean the Manifold Block

- Unscrew all M3 screws securing the valve block.

- Remove the PEEK Channel block and clean with ACN and a lint-free wipe.
- Clear all ports on the PEEK channel using a guitar string to remove debris or blockages.

6.3 Replace the Membrane

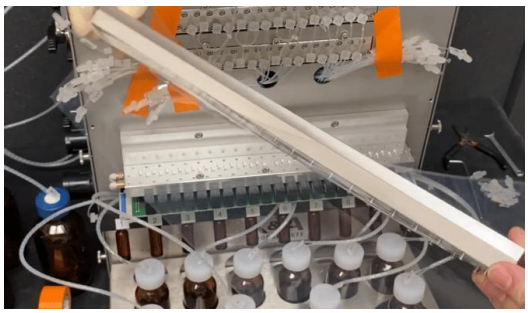
- Remove the old membrane and align the new one so screw holes match the block pattern.
- Place the membrane beneath the PEEK channel block and the valve block. Make sure the channels on the PEEK Manifold face downwards toward the membrane.
- Insert a few screws through the top manifold plate, using the holes to line up the membrane.

Figure 6-2: Aligning new membrane — channels facing downward

6.4 Reassemble Manifold Block

> **⚠ WARNING**
> Failure to evenly distribute torque or failure to align the holes correctly can lead to uneven pressure distribution or high pressure entering the low pressure pathway. Do not over-tighten or use an electric screwdriver — this can lead to cross-threading or broken screws.

- Start one screw at each end by hand using the 2.5 mm Allen wrench.
- Lightly insert remaining screws starting from the center outward to evenly distribute torque.
- Tighten all screws by hand to finish.



6.5 Repeat for Upper Membranes (If Needed)

- Repeat the above process for any upper valve blocks or multiple membranes that need replacement.

6.6 Inspect and Replace Fittings

- Inspect male luer fittings under each column. Replace if needed.
- Use a guitar string to clear any new fittings before installing.
- Use an 8 mm wrench to reinstall and tighten all fittings.
- Replace damaged fittings with flangeless spares as necessary.

Figure 6-3: Inspecting luer fittings under columns

6.7 Re-Pressurize and Test

- Turn the compressor air valve back on.
- Listen for leaks — tighten or replace fittings if needed.
- Reconnect reagent/amidite lines
- Reconnect any amidite or reagent bottles to their respective bottle caps.

- In KA Labs software, go to Manual Control to verify tubing layout and placement of lines on the manifold.
- Repressurize the argon and bottle pathways.
- Immediately inspect the main block for any signs of liquid leakage.
- Reinstall the sheet metal loom and column adapters.
- Prime the lines and verify liquid is moving as intended.
- Again inspect for liquid leaks.

7. Replacing Pneumatic Valves (As Needed)

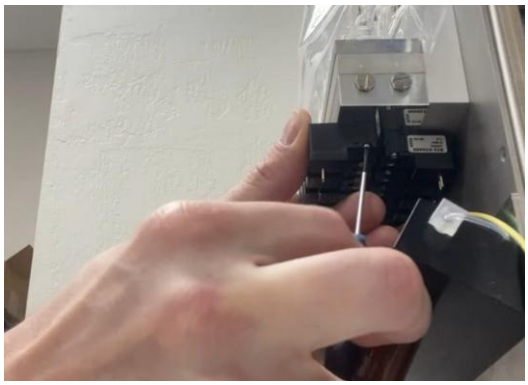
> **NOTE**
> Because of the time required to shut down and disassemble, this procedure is most efficiently performed at the same time as membrane replacement (Section 6).

1. Perform the full Shutdown Procedure (see User Manual — Shutdown Procedure).
2. Close all pressure valves.
3. Remove the protective plate (main block only).

> **⚠ WARNING**
> Be cautious while removing the electronic board. Use a flathead screwdriver and slowly inch the circuit board off evenly. Failure to do so may lead to damage to valve pins or the circuit board.

Figure 7-1: Carefully removing the electronic board

4. Carefully remove the electronic board. A flathead screwdriver may be necessary to more evenly distribute the removal force.
5. Remove the two M1.7 screws securing the faulty valve.



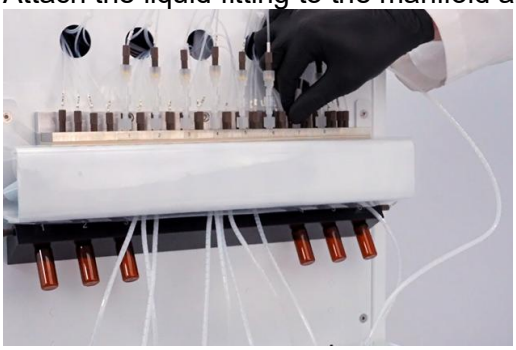
6. Inspect the new valve O-ring and sealing surface before installation. Ensure the O-ring sits within the valve and is not missing.
7. Install the new valve. It is recommended to start with only one screw before adding and securing the second screw.
8. Reassemble the electronic board and all other components.
9. Reopen the pressure system, beginning with Compressor (High-pressure) first.
10. Prime all reagent and amidite lines.
11. Verify no leaks are seen or heard.

> **NOTE**
> For valve replacement in the 5×3 upper block, access is through the side doors rather than the protective plate.

8. Changing Bottle Caps

1. Perform the shutdown procedure
2. Turn off the Argon Pressure to the instrument.
3. Run the liquid and gas lines for the new bottle cap through the slot in the bottom front of the sheet metal.
4. Open the Chamber. Attach the gas line (unlabeled line) to any available position on the appropriate gas manifold. Remove a plug if needed.

5. Pull the liquid line (labeled line) through the hole closest to its position on the main manifold.
6. Attach the liquid fitting to the manifold and tighten securely to prevent leaks.



7. Re-pressurize the instrument.
8. Verify no leaks are visible at the manifold or elsewhere before resuming operation.
9. Prime the associated reagent line before starting a synthesis run.
10. Again verify no leaks and that adequate flow from the newly installed bottle cap is acceptable. See the User Manual — Flow Rates section for flow verification procedures.

9. Troubleshooting

9.1 Common Issues

Issue	Likely Cause	Action
No flow from a line	Tubing blockage, membrane issue, valve issue, crimped gas line, or insufficient pressure	Check gas and liquid tubing for kinks. Ensure argon and compressor pressures are within operational range. Replace membrane, valve, or bottle cap as needed.
Low or inconsistent pressure	Gas leak, loose fitting or bottle cap, misfiring valve	Inspect all bottle caps and fittings. Check gas supply pressure. Inspect valves for leaks.
Poor yield / low ASWY	Chemistry issue, poor delivery, or incorrect V2	Perform additional QC methods to triangulate cause. Check reagent quality. Verify mid-synthesis priming is enabled. Review trityl histogram.
Estimate Volume not populated	Flow rates have not been calibrated	Calibrate flow rates in the Flow Rates screen. See User Manual — Flow Rates for instructions.
Software not communicating	Ethernet disconnected or incorrect settings	Verify instrument is receiving power. Check Ethernet cable connections. Verify Ethernet Card IP address is 192.168.1.1. Verify power settings are set to never sleep.
First column yield lower than others	Dead volume in pathway or ACN diluting initial deblock	Enable Mid-Synthesis Priming in Configuration. Ensure thorough priming before run.

9.2 Identifying a Pressure Leak

Signs of a leak:

- Fast pressure drop when Argon is cut off (>0.01 MPa in 1 minute)
- Visible liquid accumulation on the main block
- Air bubbles observed in reagent lines
- Irregular or reduced reagent delivery
- Trityl signals inconsistent across columns

Inspection steps:

- Inspect all luer-lock fittings and tubing connections.
- Verify bottle caps are fully tightened and O-rings intact.
- Run a Flow Rate Check to confirm proper fluid delivery.

- Confirm pressure regulators maintain stable readings.

9.3 High V2 Trityl Values

High V2 values indicate low trityl color intensity during the second detritylation measurement. Possible causes:

- Poor initial coupling
- Degraded amidites
- Incomplete priming of reagent lines prior to synthesis
- Mid-synthesis priming not enabled
- Incorrect deblock reagent concentration

Actions:

- Confirm proper priming of amidite lines
- Verify reagent freshness and storage conditions
- Check column support type
- Review synthesis protocol parameters
- Always confirm results with additional QC such as HPLC or yield analysis

9.4 Diagnostics

- Pressure verification — Confirm gauges read within specified ranges at rest and during a run.
- Flow checks — Run the Flow Rates calibration and compare values across all lines and against historical data.
- Software logs — Review synthesis log files for error messages or unexpected step durations.
- Manual Control — Use the Manual Control screen to fire individual valves and confirm flow on suspect lines.

9.5 Compressor Troubleshooting

Symptom	Possible Cause	Action
Low pneumatic pressure	Compressor regulator set too low	Adjust regulator
Pressure fluctuates significantly	Compressor cycling or leak	Inspect line connections
Moisture or oil in air lines	Reservoir not drained	Drain compressor reservoir

Liquid flow without valve actuation	Insufficient compressor (high) pressure	Verify compressor functionality and regulator settings

9.6 When to Escalate

Contact Sierra BioSystems support if you experience:

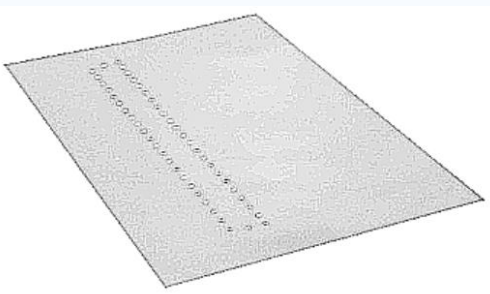
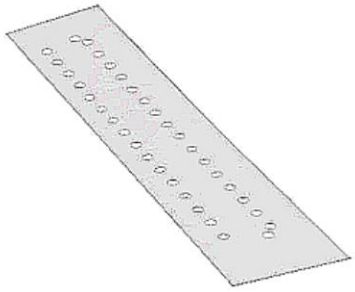
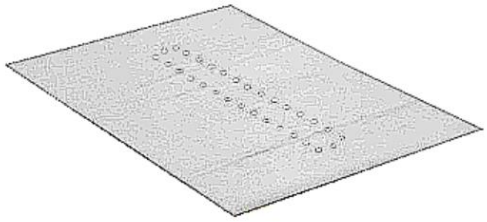
- Repeated failures that cannot be resolved by the steps above
- Electrical issues or error messages related to the valve controller or pressure sensor
- Unresolved pressure issues that do not resolve after inspecting fittings and tubing
- Any hardware damage or suspected component failure

Contact Method	Details
Support Center	support.sierrabio.com
Technical Support Email	support@sierrabio.com
General Inquiries & Parts	info@sierrabio.com or info@ka-labs.de
Phone	+1-209-396-1969
Sierra BioSystems Address	21085 Longeway Road, Sonora, CA 95370, United States
K&A Labs GmbH Address	Industriering 6, 64850 Schaafheim, Germany

10. Parts & Ordering

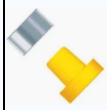
Contact Sierra BioSystems to order replacement consumables and spare parts. Below is a table of common components that might need replacement and recommended quantities.

Membranes

Part	Standard SKU	Spare Qty	Image
40-Port Membrane (H8SE / H16 / H28 / H32)	11-8003	2	
24-Port Membrane (H8 / H6 / H4)	11-8012	2	
5x3 Port Membrane (Waste Manifolds)	11-8004	4	

Tubing & Fittings

Part	Standard SKU	Spare Qty	Image
FEP Tubing, 1/16" OD × 0.030" ID	12-0007	20 ft (~6 m)	

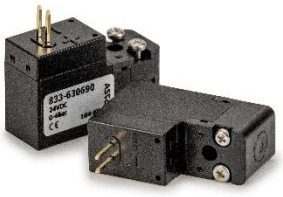
Super Flangeless Nut Headless, 1/16" OD	10-0222	10	
Super Flangeless Ferrule with SST Ring, 1/16" OD	10-0144	10	
Luer Fitting, 1/4"-28 UNF Female (top)	10-8016	8	
Luer Fitting, 1/4"-28 UNF Male (bottom)	10-8015	8	
Tefzel (ETFE) Plug, 1/4-28	10-0228	10	

Bottle Caps & Daisy Chains

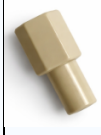
Part	Standard SKU	VLS SKU	Spare Qty	Image
20-400 Bottle Cap	03-0041	03-0042	1	
28-400 Bottle Cap	03-0044	03-0045	1	

GL38 Bottle Cap	03-0050	03-0051	1	
GL45 Bottle Cap	03-0052	03-0053	1	
GL38 Daisy Chain	03-0073	—	1	—
GL45 Daisy Chain	03-0074	—	1	—

Valves & Filters

Part	Standard SKU	Spare QTY	Image
Pneumatic Valve (Micro 10, 3/2-way)	13-8001	10	
Particle Filter, 10 µm, for 1/16" OD Tube	22-0037	40	

Syringe Column Adapters

Part	Standard SKU	Spare Qty	Image
1 mL Syringe Column Adapter	15-8057	As needed	
3 mL Syringe Column Adapter	15-8058	As needed	
6 mL Syringe Column Adapter	15-8059	As needed	
12 mL Syringe Column Adapter	15-8055	As needed	
20 mL Syringe Column Adapter	15-8056	As needed	

For purchasing inquiries, availability, or pricing, contact:

- Email: sales@sierrabio.com or info@ka-labs.de
- Support Center: https://support.sierrabio.com

For purchasing inquiries: sales@sierrabio.com or info@ka-labs.de

Appendix A — Compressor Installation

Overview

The K&A Synthesizer requires a clean, stable source of compressed air to actuate the pneumatic valves that control reagent delivery. Each system is supplied with a dedicated air compressor. Proper installation and maintenance of the compressor are essential to ensure reliable valve actuation and consistent synthesis performance.

> **NOTE**
> A filtered laboratory high-pressure air source may also be used provided it delivers clean dry air, remains within the specified pressure range, and does not experience pressure shutdowns or fluctuations.

Compressor Requirements

- Clean, dry, oil-free compressed air
- Operating pressure between 65–80 psi (0.41–0.55 MPa)
- Stable pressure with no automatic shutdown during synthesis runs

Shared Compressor Use

A single compressor may supply two K&A Synthesizers, provided sufficient pressure and flow capacity are maintained. The supply pressure should be set to a minimum of 80 psi (.55 MPa) upstream of both instruments to ensure pressure does not drop below the required operating range when both instruments are actuating valves simultaneously.

Installation Procedure

Step 1. Find the Accessories

Locate the bag of accessories attached to the compressor. The bag should include:

- Tube for oil dispensing
- Tube for water removal
- Muffler
- 1/4" Male NPT x 1/4" Male NPT Adapter

Also locate the compressor oil.

Step 2. Position the Compressor

Place the compressor on a stable surface near the instrument. Ensure there is adequate ventilation around the compressor to prevent overheating.

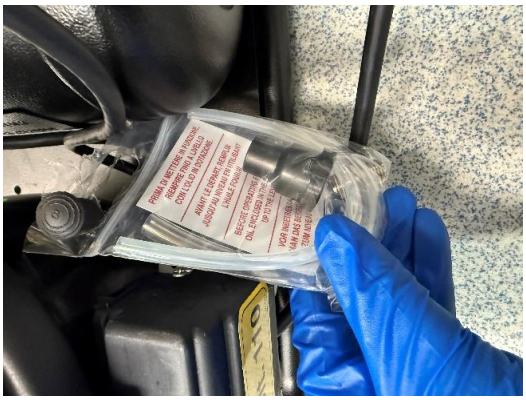


Figure A-1: Compressor accessory bag contents

Step 3. Add Compressor Oil

Locate the oil fill port. European units: typically on the left side. North American units: typically on the right side.

- Remove the rubber cap plugging the oil inlet hole.
- Using the included oil bottle and tubing, pour oil slowly into the designated oil container.
- Monitor the bubble level indicator on the compressor.
- Stop when the indicator is approximately half full (typically 70–80% of the bottle content).
- Reattach the rubber cap.

> **⚠ CAUTION**
> Do not overfill. Overfilling can damage the compressor.

Step 4. Attach Muffler

- Remove the rubber cap from the port on the opposite side of the compressor (not the oil port).
- Add the muffler to that port.

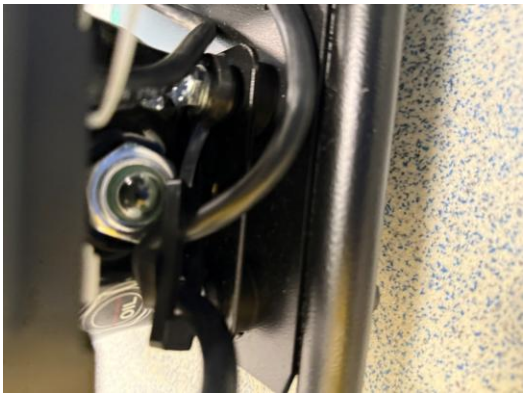


Figure A-2: Attaching muffler to exhaust port

Step 5. Connect Water Removal Tubing

Attach the silicone water removal tube to the designated port. Ensure the vent output is securely closed.

Step 6. Install Regulator and Filter Assembly

- Apply Teflon tape to the 1/4" NPT-to-1/4" or 6mm fitting (included).
- Using an Allen wrench for control, thread the fitting into the regulator/filter assembly.
- Using a crescent wrench, attach the regulator/filter assembly to the compressor.
- Ensure all connections are snug and airtight.

Step 7. Verify System Controls

Familiarize yourself with the compressor controls:

- Power Switch — turns compressor on/off
- Manual Pressure Switch — activates/deactivates compressor
- Pressure Adjustment Dial — sets output pressure
- Water Removal Switch — releases accumulated moisture
- Pressure Gauge — displays current output pressure
- Water Trap / Regulator Assembly — stabilizes air output

Step 8. Connect to the Instrument

Connect the 1/4" or 6 mm output tubing from the regulator to the Compressor (High-Pressure) inlet on the synthesizer. Ensure all fittings are secure and cannot be easily detached.

Figure A-3: Adjusting compressor output pressure

Step 9. Set Compressor Output Pressure

- Ensure the compressor is on auto and allowed to build pressure.
- Turn on the Manual Pressure switch.
- Locate the pressure adjustment dial on the compressor regulator.
- Observe the pressure gauge on the compressor.
- Adjust the regulator until the compressor output pressure reaches approximately 80 psi (0.55 MPa).

Step 10. Set Instrument Operating Pressure

Open the ball valve for the Compressor pressure on the instrument. Confirm/adjust that the compressor regulator is set within the required operating range: 0.30 – 0.40 MPa (approximately 44–58 psi at the instrument regulator).

NOTE

If the compressor pressure is set too high, you may need to decrease the pressure and actuate the valves to see the new lower pressure.

Operating Notes

- The compressor should remain powered on during synthesis runs to ensure continuous pneumatic pressure.
- If an external laboratory compressed air source is used, it must meet the same clean, dry, oil-free requirements.
- Sudden loss of pneumatic pressure during a synthesis run can cause incomplete valve actuation and synthesis failure.

⚠ WARNING

Never disconnect the compressor air line while the instrument is pressurized. Always perform the full Shutdown Procedure before disconnecting pneumatic lines or servicing the compressor.

⚠ CAUTION

Open reservoir drain valves slowly when releasing accumulated water. Pressure may be present inside the compressor tank.

Appendix B — Compressor Maintenance Record

Use this log to track compressor maintenance. Photocopy this page or continue on additional pages as needed.

Field	Entry
Instrument Model	
Serial Number	
Location	
Installed Date	

Compressor Pressure (MPa)	Oil added (Y/N)	Water Drained (Y/N)	Notes (e.g., “dirty water,” “oil topped off”)	Initials	Date

Compressor Pressure (MPa)	Oil added (Y/N)	Water Drained (Y/N)	Notes (e.g., “dirty water,” “oil topped off”)	Initials	Date

Appendix C — General Maintenance Log

Use this log to track replacement of critical wear components.

Field	Entry
Instrument Model	
Serial Number	
Location	
Installed Date	

Component	Typical Replacement Frequency
Membrane	Every 4 months, range 3–6 months acceptable
Pneumatic Valve	As needed (based on performance or failure)
Bottle Caps / Fittings	As needed (wear, leaks, or contamination)

Membrane Replacement Log

Record each membrane replacement below. Photocopy this page or continue on additional pages as needed.

Date	Reason for Replacement	Performed By	Notes

Pneumatic Valve Replacement Log

Record each valve replacement below. Photocopy this page or continue on additional pages as needed.

Date	Reason for Replacement	Performed By	Notes

Bottle Cap / Fitting Replacement Log

Record each bottle cap or fitting replacement below. Photocopy this page or continue on additional pages as needed.

Date	Reason for Replacement	Performed By	Notes

NOTE

Always follow procedures in Section 4 — Maintenance Schedule. Record any abnormalities observed during replacement. If repeated failures occur, contact Sierra BioSystems support at support@sierrabio.com or info@ka-labs.de.

Appendix D — Technical Glossary

This glossary covers technical terms relevant to service and maintenance of the K&A Oligonucleotide Synthesizer.

ACN (Acetonitrile) — A solvent used for washing columns and clearing lines. Also used to wash the trityl monitor vials during shutdown.

Allen Wrench (Hex Key) — A tool used to tighten M3 screws on the valve block assembly during membrane replacement. A 2.5 mm Allen wrench is required for the main manifold block.

ASWY (Average Step-Wise Yield) — A calculated metric representing average coupling efficiency per synthesis cycle. Formula: ASWY = [Total Yield ^ (1 / Number of Cycles)] × 100. Well-optimized synthesis typically achieves 97–99% ASWY.

Bottle Cap — A sealed cap fitted with gas and liquid line connections that pressurizes reagent and amidite bottles and routes fluid to the instrument manifold. Multiple cap sizes are available: 20-400, 28-400, GL38, GL45, and VLS variants.

Bypass Connector — A small fitting installed in unused column positions to ensure any misdirected reagent flows to waste rather than an open port.

Compressor — The air compressor supplied with the instrument. Provides compressed air at 65–80 psi to actuate pneumatic valves. Requires weekly maintenance including water drainage and oil level checks.

Coupling — The chemical reaction in which an activated phosphoramidite is joined to the 5'-hydroxyl of the support-bound nucleoside chain, extending the oligonucleotide by one base. Coupling efficiency directly determines overall synthesis yield.

CPG (Controlled Pore Glass) — A common solid support material used in oligonucleotide synthesis columns.

Dead Volume — The empty space in a reagent line or manifold between the bottle and the column before any delivery occurs. Eliminated by priming before synthesis.

Deblock (Detritylation) — The synthesis step that removes the DMT protecting group from the 5'-hydroxyl, releasing the orange trityl cation measured by the trityl monitor.

DMT (4,4'-Dimethoxytrityl) — An acid-labile protecting group on the 5'-hydroxyl of each phosphoramidite. Removed during the deblock step of each synthesis cycle. DMT-On synthesis retains the final DMT group for purification purposes.

Ferrule — A small compression fitting component used with flangeless nuts to create a leak-tight seal on tubing connections. Available in 1/16" and 1/8" OD sizes.

FEP Tubing — Fluorinated ethylene propylene tubing used throughout the instrument's fluid pathway. Available in 1/16" OD x 0.030" ID and 1/8" OD x 1/16" ID sizes.

Flow Rate — The measured volume delivered per unit time for each reagent and amidite line. Calibrated monthly and used by the software to calculate Estimate Volume figures.

Luer Lock — A standardized threaded fitting system used to connect synthesis columns to the instrument's fluid lines. Column luer lock adapters should be cleaned monthly.

M1.7 Screw — The small screws securing individual pneumatic valves to the valve block. Two M1.7 screws are removed to replace a faulty valve.

M3 Screw — The screws securing the valve block assembly together. Tightened hand-tight using a 2.5 mm Allen wrench during membrane reassembly. Never use an electric screwdriver.

Main Block — The central manifold block that routes reagent and amidite delivery to the synthesis columns. Houses the 40-port sealing membrane, replaced every 4 months.

Manifold — The internal common channel within the valve block through which reagents flow after passing through the membrane.

Membrane — A flexible sealing element within the valve block that controls fluid flow. The main block membrane (40-port) is replaced every 4 months. Upper block membranes (5x3) are replaced as needed or annually.

Muffler — A small component attached to the compressor exhaust port to reduce operating noise.

NPT (National Pipe Thread) — A standard thread type used on compressor fittings. The regulator/filter assembly uses a 1/4" NPT adapter to connect to the compressor output.

O-Ring — A rubber sealing ring used in pneumatic valves and bottle caps. Must be inspected and confirmed present before installing a replacement valve.

PEEK (Polyether Ether Ketone) — A chemically resistant plastic used for the channel block in the valve manifold assembly. Cleaned with ACN and a lint-free wipe during membrane replacement.

Pneumatic Valve — An electrically actuated valve that controls compressed air flow to the sealing membrane, enabling or blocking reagent delivery on each channel. Part number 13-8001.

Pressure Ball Valve — A manual valve used to open and close the argon supply to reagent and amidite bottle groups.

Pressure Regulator — A device that maintains correct gas pressure for either the fluid delivery circuit (argon, 0.04–0.07 MPa) or pneumatic control circuit (compressed air, 0.30–0.40 MPa).

Priming — The process of pushing fresh reagent or amidite through a line to eliminate dead volume before synthesis. Recommended before every run, after bottle changes, and after idle periods.

Sight Glass — A transparent window on the compressor used to visually verify oil level. Oil should be maintained at the midpoint of the sight glass.

Solid Support — The insoluble matrix (typically CPG or polymer beads) contained within the synthesis column, to which the first nucleoside is attached and upon which the oligonucleotide chain is built stepwise.

TCA (Trichloroacetic Acid) — A commonly used deblocking reagent that removes the DMT protecting group during the deblock step. Also referred to as deblock solution.

Trityl Monitor — An optical photometer that measures absorbance of the orange trityl cation released during each deblock step at 470 nm. Used to estimate coupling efficiency during synthesis.

Upper Block — The 5x3 valve blocks located above the main block, controlling waste manifold routing. Membranes replaced annually or as needed.

V2 — The trityl transmission measurement taken during the second trityl collection of the synthesis. Serves as the baseline reference value for all subsequent yield calculations. High V2 values indicate poor coupling.

Waste Container — The external vessel connected to the instrument's waste manifold lines that collects all waste solvents and reagents expelled during synthesis, priming, and shutdown. Must be monitored regularly and disposed of in accordance with applicable chemical waste regulations.

Waste Manifold — The network of tubing and fittings that routes all waste fluid away from the synthesis columns and trityl monitor to the external waste container.

Water Trap — A component on the compressor regulator assembly that collects moisture from the compressed air. Must be drained weekly to prevent water from entering the instrument pneumatic system.