HALCYON™ AMBIOS

HALCYON™ WORLDWIDE
DIVE SYSTEMS EST.96

_REBREATHER MANUAL

Version 1.2 - 11/25

TABLE OF CONTENTS

1 General Information And Warnings

1.1 Introduction

The Symbios CM Rebreather, together with a compatible dive computer, is classified as Personal Protective Equipment under the EU Regulation 2016/425 and protects against risks listed under PPE Risk Category III (a): substances and mixtures which are hazardous to health.

Based on EU PPE Regulation 2016/425 Annex I, the Symbios CM Rebreather protects the user/diver from the risk of:

- atmospheres with oxygen deficiency
- drowning

by providing breathing gas, and further recycling of the breathing gas including scrubbing CO_2 and automatic PO_2 control. The rebreather alerts the diver in cases where the tank pressures are low or where the PO_2 is <0.4 bar or higher than 1.6 bar.

This personal protective equipment is designed for underwater use. The PPE protects against these risks only when used correctly. This product may only be used if the user is thoroughly familiar with this manual and has received training from an accredited training agency specifically designed for diving with Symbios CM Rebreather. The user of the device must be certified by the appropriate agency to use the Symbios CM Rebreather.

NOTICE

Mandatory Reading

You must read and fully understand this manual and the manual of the compatible dive computer before using the Symbios CM Rebreather.

For the latest versions, updates, and downloadable manuals, please visit:
Halcyon Symbios Manuals

In this manual, the following three precautionary messages are used: WARNING, CAUTION, and NOTICE symbols provide users with necessary information about potential hazards and proper procedures.

⚠ WARNING

WARNING statements describe potentially hazardous situations which, if not avoided, could result in serious injury or even death.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE statements are used to provide important information regarding installation, operation, maintenance, performance, general important tips, or instructions for a procedure or situation that, if not performed properly, might cause damage to the device but is unrelated to physical injury.

1.2 Warnings

Quick Safety Warnings – Symbios CM Rebreather

Read Before Use!

⚠ WARNING

Training Required – The Symbios CM Rebreather may be used only after completing certified training with an authorized instructor.

⚠ WARNING

Not a Substitute for Training – This manual is a reference only; it does not replace formal rebreather instruction.

⚠ WARNING

Life-Support Risk – A CCR can fail without warning. Always carry an independent bailout system sufficient for a safe ascent.

⚠ WARNING

Mandatory Checks – Perform all pre-dive tests, monitor PO_2 continuously, and follow service intervals exactly as specified.

⚠ WARNING

No Unauthorized Modifications – Alterations or non-approved parts void CE certification, warranty, and manufacturer responsibility.

⚠ WARNING

Approved Use Only – Use only with certified cylinders and components that comply with the regulations of the country of use.

⚠ WARNING

Diver Responsibility – Safe operation depends on your vigilance, training, and adherence to manufacturer instructions.

⚠ WARNING

OXYGEN FIRE / EXPLOSION RISK
Oxygen handling poses serious fire and explosion hazards. Strict adherence to the following rules is mandatory:

⚠ WARNING

All components connected to the oxygen regulator must remain oxygen-cleaned and oxygen-compatible. This includes hoses, hose connections, fittings, HP hoses, and LP hoses.

⚠ WARNING

Connection or disconnection of oxygen hoses may only be performed by trained personnel qualified in oxygen-clean servicing.

⚠ WARNING

Never connect or disconnect hoses in a contaminated or non-oxygen-clean environment. Hydrocarbons, grease, dust, or particles may act as ignition sources.

⚠ WARNING

Never use an oxygen cylinder warmer than 30°C/86℉. High temperature increases ignition risk.

⚠ WARNING

Always pressurize the system slowly. Note: Opening a valve slowly is not the same as pressurizing slowly. Ensure gradual pressurization to avoid adiabatic heating.

⚠ WARNING

Fully depressurize hoses before disassembly. Opening or removing fittings under pressure may cause fire or explosion.

⚠ WARNING

Only approved lubricants and sealing materials may be applied to oxygen service components. Unapproved materials may ignite under oxygen exposure.

⚠ WARNING

Failure to comply with these requirements creates a severe risk of fire, explosion, serious injury, or death.

⚠ WARNING

The manufacturer accepts no responsibility or liability if these rules are not strictly followed.

⚠ WARNING

By diving with the Symbios CM Rebreather, you acknowledge these risks and accept all responsibility for proper use and compliance with EU CE standards.

1.3 Manufacturer Information

Halcyon Manufacturing
24587 NW 178th Pl
High Springs, FL 32643, USA
info@halcyon.net

1.4 Certification

Module B Halcyon: CW/PPER/9/08/2025

———————————

Module D Halcyon: CW/PPER/10/08/2025

2 Overview

2.1 Introduction

Congratulations on choosing the Halcyon Symbios CM Rebreather. This chest-mounted closed-circuit rebreather represents the latest generation of Halcyon engineering, combining years of development and field testing into a lightweight, reliable, and highly capable system.

The Symbios CM Rebreather is designed to deliver dependable performance across a wide range of diving environments, meeting the needs of both recreational explorers and advanced technical divers. Its compact design, innovative chest-mounted configuration, and cutting-edge electronics make it equally suitable for travel, training, and expedition-level missions.

At the heart of the Symbios CM Rebreather are the principles of redundancy, flexibility, and durability. The system integrates proven CO_2 scrubbing technology with advanced oxygen monitoring and wireless connectivity, ensuring you can focus on the dive while maintaining precise control of your life-support system. Features such as quick assembly, intuitive disassembly, and seamless integration with the Halcyon Symbios ecosystem provide additional safety, efficiency, and ease of use.

Your Symbios CM Rebreather is intended for properly trained and qualified divers who can assemble, prepare, and operate the unit in accordance with the instructions provided in this manual. With correct training and care, the Symbios CM Rebreather will become a trusted partner for dives ranging from shallow recreational excursions to demanding technical explorations.

2.2 Safety Considerations

Before using the Symbios CM Rebreather, please read and understand the information provided in this manual in its entirety. Be aware that diving has many inherent risks. A rebreather computer can expose you to risk of serious injury or death caused by decompression sickness, oxygen toxicity, or other inherent risks of diving.

You should not use the Symbios CM Rebreather if you are not aware of or if you do not accept those risks.

Any subsequent changes or updates of this manual will be available on halcyon.net and factory approved instructors.

2.3 Limitations of Use

2.3.1 Depth Limits

The Symbios CM Rebreather has been tested and certified in accordance with EN 14143:2013 to a maximum operating depth of 100 m/330 ft.

- When used with air as the diluent, the maximum operating depth is 40 m/130 ft, due to oxygen partial pressure and narcosis considerations.
- When used with trimix as the diluent, the maximum operating depth is 100 m/330 ft, subject to appropriate training, certification, and dive planning.

⚠ WARNING

Exceeding these limits voids CE compliance and may result in serious injury or death.

2.3.2 Temperature Limits

The Symbios CM Rebreather is approved for use within the temperature range of +4 °C/39 °F to +34 °C/93°F in accordance with EN 14143:2013.

- Short-term storage: -10 °C/50°F to +50 °C/122 °F

- Long-term storage: +5 °C/41 °F to +20 °C/68 °F

⚠ CAUTION

Use outside the approved operational range may lead to unreliable function, reduced scrubber performance, or injury to the diver.

2.3.3 Scrubber Duration Limits

⚠ CAUTION

Scrubber Duration and CO_2 Risk
The Symbios CM Rebreather is fitted with an axial CO_2 scrubber tested in accordance with EN 14143:2013.

- Maximum validated operating duration: 160 minutes (2 hours 40 minutes) at:
    - RMV: 40 L/min
    - CO_2 injection: 1.6 L/min
    - Water temperature: +4 °C/39 °F
    - Depth: 40 m/130 ft profile

⚠ WARNING

The scrubber duration is highly dependent on work rate, water temperature, depth, and breathing conditions. Exceeding the validated duration or diving under higher workloads may lead to premature CO_2 breakthrough and presents a serious risk of hypercapnia.

2.4 Risks Assessment

2.4.1 Work Rates

The Symbios CM Rebreather has been tested in accordance with EN 14143:2013 under the following respiratory minute volumes (RMV):

- 40 L/min RMV – Standard test condition for CO_2 scrubber duration and performance evaluation
- 62.5 L/min RMV – Elevated workload reference for bailout performance testing
- 75 L/min RMV – Maximum workload limit for work of breathing compliance

Performance of the Symbios CM Rebreather is certified within these ranges. Use above these limits has not been evaluated under CE standards and may compromise safety.

⚠ WARNING

Divers should assume reduced scrubber endurance and increased oxygen consumption at higher workloads and must apply conservative safety margins when planning dives under strenuous conditions.

2.4.2 Vertical Head-Up or Head-Down Position

⚠ CAUTION

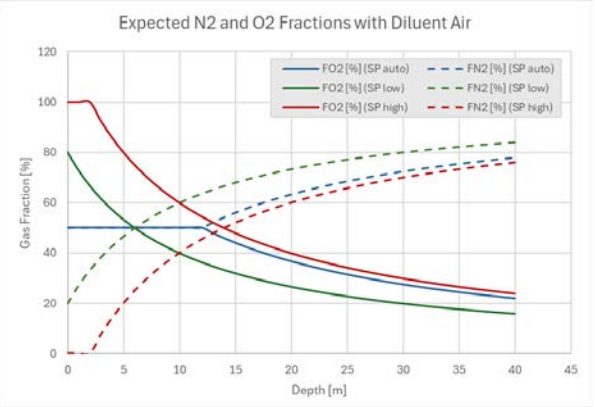
CAUTION – Diver Position and Variability of Breathing Performance

- The Symbios CM Rebreather is CE-tested in accordance with EN 14143:2013 but breathing resistance changes as divers move through various in-water positions.
- If experiencing discomfort, divers should switch immediately to an open-circuit bailout system until comfortable breathing is regained.

2.4.3 Expected inspired gas concentrations

The expected setpoint range for the rebreather is 0.5 to 1.4 bar. In the default control mode, the fraction of oxygen (FO_2) is maintained constant down to a depth of 12 m/40 ft. Below this depth, the setpoint automatically shifts to 1.1 bar. In addition, two fixed setpoints, 0.8 bar and 1.2 bar, are available for manual selection.

The following graph illustrates the oxygen (O_2) and nitrogen (N_2) fractions when using diluent air, showing how they vary with depth and setpoint mode.



Diving beyond the maximum recommended recreational depth of 40 meters requires specialized training, as risks increase significantly. Reaching the maximum operating depth of 100 meters necessitates the use of a Trimix 10/70 diluent (10% O_2; 70% He; 20% N_2) and may only be attempted by properly trained and qualified divers.

⚠ CAUTION

Oxygen Exposure Limits

- The Symbios CM Rebreather is certified for operation with oxygen setpoints between 0.5 and 1.4 bar PO_2 (EN 14143:2013).
- Hypoxia risk: Inspired PO_2 below 0.16 bar may cause unconsciousness and death.
- Hyperoxia risk: Inspired PO_2 above 1.6 bar may cause CNS oxygen toxicity and convulsions, with risk of drowning.
- Divers must select setpoints appropriate to the planned depth, workload, and gas mixture, and must continuously monitor PO_2 during all phases of the dive.
- Oxygen exposure must be managed in accordance with recognized standards (e.g., NOAA CNS and OTU tables) and the diver's training.

2.4.4 Visibility

⚠ WARNING

Visibility Requirement

During a dive, the diver must be able to clearly and continuously read all critical information displayed on the handset and/or HUD. In accordance with EN 14143, safe operation of a rebreather requires that the user is always capable of monitoring life-support data.

The Symbios CCR must therefore only be used in water where the visibility exceeds approximately 30 cm/ 1 ft. Operating the rebreather in conditions that prevent the diver from reading the handset display or the HUD significantly increases the risk of equipment misuse, failure to detect unsafe PO_2 levels, and subsequent injury or death.

2.4.5 Use of High Oxygen Content Gases

The Symbios CM Rebreather can maintain oxygen partial pressures within the CE-approved range of 0.5 to 1.4 bar PO_2. Use of high oxygen fractions requires strict adherence to established oxygen exposure guidelines.

- CNS Oxygen Toxicity is a function of oxygen pressure and exposure time. Divers must plan dives within the NOAA CNS limits or equivalent recognized standards.
- Pulmonary Oxygen Toxicity results from prolonged exposure above 0.5 bar PO_2. This is monitored using Oxygen Toxicity Units (OTUs).
  - 1 OTU = 1 minute at 1.0 bar PO_2 while breathing 100% oxygen.
  - The most conservative limits recommend a maximum of 300 OTUs per day during repetitive or multi-day diving activities.
- Divers are responsible for calculating cumulative OTUs using procedures provided by NOAA or other recognized training organizations (e.g., GUE, IANTD, TDI).

⚠ CAUTION

Oxygen Exposure

Failure to monitor and limit CNS% and OTU values may lead to convulsions, pulmonary injury, unconsciousness, or death.

2.4.6 Potential Long-Term Health Effects

At the time of publication, there are no conclusive scientific studies available regarding the long-term health effects of repeated rebreather use and exposure to elevated oxygen partial pressures.

- Divers should be aware that prolonged or repeated exposure to increased PO_2 may have unknown cumulative health impacts.
- It is the diver's responsibility to remain informed of current scientific findings and professional guidance concerning long-term oxygen exposure.

NOTICE

User Responsibility

Long-term health risks associated with CCR diving are not fully established. Divers should apply conservative practices and remain informed through recognized training agencies and medical authorities.

2.4.7 Bailout Requirements

The Symbios CM Rebreather is a life-support system and may fail without warning. In accordance with diving practice, divers must carry an open-circuit bailout system suitable for the planned dive profile.

- The bailout supply must provide sufficient breathing gas to allow a controlled ascent, including required decompression, from the maximum depth and under foreseeable emergency conditions.
- Bailout equipment must be configured for immediate access and tested prior to each dive.
- During dives where elevated work rates, extended penetration, or increased decompression obligations are expected, additional bailout capacity must be considered.

⚠ CAUTION

Bailout Preparedness

Failure to carry and maintain a properly sized bailout system may result in the inability to complete a safe ascent following CCR malfunction, leading to serious injury or death.

2.5 Scope of Functionality and Features

2.5.1 General Description and Operating Principles

The Symbios CM Rebreather is designed as a highly efficient gas-saving system, extending dive duration by recycling breathing gas through advanced CO_2 scrubbing. Its unique wireless functionality seamlessly links the CCR head with Symbios Handsets and HUDs, providing divers with real-time PO_2 monitoring and system feedback without the need for cables. This combination of gas efficiency and streamlined wireless integration delivers enhanced safety, reliability, and freedom of movement underwater.

NOTICE

Electronic CCR Head

The electronic CCR head automatically controls the PO_2 of the breathing gas. Wireless communication is used only to transmit rebreather data to the Handset and HUD. These devices display PO_2 and other relevant information but have no influence on setpoint control.

NOTICE

The electronic CCR head contains an integrated vibration motor, functioning as an active warning device. It alerts the diver when PO_2 rises above or falls below safe limits.

2.5.2 Technical Diagram

The Symbios CM Rebreather is a chest-mounted closed-circuit rebreather consisting of the following main components:

- CCR Canister – containing the axial CO_2 scrubber and the oxygen cylinder mounting base.
- CCR Head – incorporating the control electronics, solenoid valve, three oxygen sensors, and connections for both high-pressure (HP) and intermediate-pressure (IP) oxygen hoses. Two oxygen sensor slots are dedicated for analog sensors with the third being able to receive a Halcyon GreenFlash™ Optode, digital or approved analog sensor.
- Combination ADV/BOV Valve – serving as both an automatic diluent valve (ADV) and bailout valve (BOV), with a direct diluent supply connection.
- Inhalation and Exhalation Counterlungs – asymmetrical 3D counterlungs designed for optimal work-of-breathing performance.
- Breathing Loop – fitted with a Dive Surface Valve (DSV) for isolating the loop when on the surface.
- Oxygen Regulator with Integrated MAV – enabling manual oxygen addition.
- Diluent Connection Hose – for easy connection to a variety of supply tanks.
- Protective Outer Bag – a robust enclosure covering the rebreather, providing protection and multiple mounting points for secure attachment to the diver.

⚠ CAUTION

The Symbios CM Rebreather must be equipped with an oxygen cylinder meeting national certification standards, appropriate for oxygen service and sized for the planned dive duration.

2.5.3 Basic Operating Principle

– The diver's exhaled gas is directed into the breathing loop.

– The gas passes through a CO_2 absorbent scrubber, where carbon dioxide (CO_2) generated by metabolism is chemically removed.

– Oxygen (O_2) metabolized by the diver is replenished by addition from the onboard supply. Oxygen addition is controlled by:

  – Automatic solenoid injection, based on the setpoint selected and monitored by the electronics.

  – Manual addition valves (MAVs), which allows the diver to add oxygen as required.

– Diluent is replenished by addition from an offboard supply. Addition is controlled by:

  – Automatic Diluent Valve (ADV), which provides diluent with reduced counterlung volume.

  – The Symbios CM Rebreather uses an integrated ADV and BOV that also allows manual addition of diluent from the same onboard regulator.

– The inspired gas composition continuously changes during the dive, automatically maintaining the oxygen partial pressure (PO_2) within the chosen setpoint range (0.5 – 1.4 bar).

2.5.4 Functional Flow of the Breathing Loop

1. Inhalation – The diver breathes gas from the counterlungs, which deliver the scrubbed and oxygen-regulated mixture.
2. Gas Monitoring – The diver continuously monitors PO_2 via the Symbios HUD and Handset displays, with redundant sensor systems providing real-time feedback.
3. Exhalation – Exhaled gas re-enters the loop, passes back through the counterlungs, and is routed through the scrubber canister.
4. CO_2 Absorption – The scrubber medium removes carbon dioxide from the exhaled gas.
   Oxygen Addition – Oxygen is injected automatically or manually to maintain the selected setpoint. Diluent may also be added to manage loop volume, PO_2, or buoyancy.
5. Cycle Repeats – The purified and oxygen-balanced gas is then inhaled again, completing the closed breathing cycle.

NOTICE

User Responsibility

The Symbios CM Rebreather does not remove the risks of hypoxia, hyperoxia, or hypercapnia. Proper training, vigilant monitoring, and adherence to operating procedures are essential for safe use.

3 Technical Characteristics and Design

This chapter provides a detailed design description and outlines the technical characteristics of the Symbios CM Rebreather. It is intended to give the diver a deeper understanding of the unit's construction and functionality.

3.1 Technical Specifications

Specification	Details
Dimensions	399 × 300 × 120 mm^3
Weight	• Excluding soda lime and cylinder: 6.6 kg/14.6 lbs (travel weight) • Excluding cylinder, incl. 2.35 kg soda lime: 8.9 kg/9.6 lbs • Incl. 2.35 kg/5.2 lbs soda lime + 1L 200 bar steel cylinder: 11 kg/24.3 lbs
Scrubber	• Type: Axial scrubber (large cross-section, short bed length) • Soda Lime: 2.35 kg/5.2 lbs Sofnolime™ 797 • Endurance: 160 min (EN14143:2013, RMV 40 l/min, CO_2 1.6 l/min, 4 °C/39°F water) • Profile – 40m: 40 min @ 40m → 5 min @ 12m → rest @ 6m • Profile – 100m: 10 min @ 100m → staged ascent (39m → 36m → 33m → … → 9m) → rest @ 6m ** Test Data based solely upon Sofnolime™ 797. Results will vary with media, temperature, and exertion.
Onboard Oxygen Supply Duration	• 1L 200 bar cylinder: ~84 min • 2.5L 200 bar cylinder: ~211 min (Both with 50 bar safety margin) Note: O_2 and diluent cylinders not included Diluent duration varies.

Batteries & Power	• 2× Li-Ion, 3.6V, 500 mAh • Standby draw <100 µA → ~1 year • Active: 12–22 mA • Diving: 30–40 mA (depends on solenoid use & alarms)
Counterlung Volume	• Inhale 5.4L/1.43 gal • Exhale 2.5L/0.66 gal
Max Depth	• Air as diluent: 40m/130ft • Trimix as diluent: 100m/330ft
Gas Purity	• Air: DIN EN 12021 • Oxygen: >99.5% medical O_2 • Helium: >99.996%
Surface Pressure Range	800–1050 mbar
Cylinders	O_2 Cylinder: 0.8–2.5L, EN 144-1 threads (M18×1.5 or M25×2), EN ISO 10297 compliant. Diluent Cylinder: ≥2L 200 bar, EN 144-1 threads, EN ISO 10297 compliant, connections per EN ISO 12209 or EN 144-3.
First Stages	• O_2: M26×2 (CE) or DIN 200 bar, 5/8" (Intl.), IP 7–7.5 bar/101.5–108.8 psi • Diluent: DIN 5/8", IP 9.5–10 bar/138–145 psi (EN250:2014 compliant)
Oxygen Setpoints	• Auto: 50% O_2 up to 12m, then 1.1 bar (user adjustable between 1.0 and 1.2 bar) • Low: 0.8 bar (user-selectable) • High: 1.2 bar (user-selectable) • Auto-controlled by CCR head; handset/HUD for display only
O_2 Alerts	• Low <0.4 bar • High >1.6 bar • Warnings: Blinking, pop-ups, vibration (handset + CCR head)

O_2 Sensors	• S1 & S2: Analog (AST-14 D or PSR-11-39-SMB) • S3: GREENFLASH fluorescence or analog
O_2 Setpoint Range	0.5 – 1.4 bar
Temperature Ranges	• Diving: +4°C/39 °F to +34°C/93.2 °F • Short-term storage: -10°C/14 °F to +50°C/122 °F • Long-term storage: +5°C/41 °F to +20°C/68 °F
Connectivity	• BT • USB (data + charging, max 300 mAh) • 125 kHz magnetic transmitters (dual, ~1m range)
Work of Breathing	• CC: <2 J/L @ 40m (air diluent, 4°C/41 °F, RMV 75L/min (2.19 ft^3/min) • CC: <2 J/L @ 100m (TX10/70, 4°C/41 °F , RMV 75L/min (2.19 ft^3/min) • Bailout: 2.5 J/L @ 50m (air, 4°C/41 °F , RMV 62L/min (2.19 ft^3/min) • EN14143:2013 limit (CC): 2.8 J/L @ 75L/min (2.19 ft^3/min) RMV • EN250:2014 limit: 2.5 J/L @ 50m, 62L/min (2.19 ft^3/min) RMV
Safety Notes	• Diver must regularly monitor computers • System does not auto-inject diluent → manual monitoring of PO_2 required

3.2 CO_2 Scrubber

The CO_2 Scrubber contains all the components necessary to perform the gas scrubbing function and supports the mounting base for the onboard oxygen cylinder. The module consists of the CO_2 canister case and the CO_2 absorbing canister.

3.2.1 CO_2 Canister Case

The CO_2 canister case houses the CO_2 absorbing canister. At its base is the oxygen cylinder mounting bracket. Laser-engraved markings on one side of the canister guide correct assembly orientation. These engravings must always face the diver's body for proper alignment. The case design also provides thermal insulation, improving the performance and efficiency of the CO_2 absorption process.

3.2.2 CO_2 Absorbing Canister

The Symbios CM Rebreather is fitted with an axial CO_2 scrubber designed for quick and reliable packing.

- Scrubber absorbent capacity: 2.35 kg when filled with Sofnolime™ 797.
- The maximum safe operating time for the scrubber is 160 min, determined in accordance with EN 14143:2013 compliant testing protocols (constant 6m, 40m profile or 100m profile, at 40 L/min RMV, 1.6 L/min CO_2 injection, and +4 °C/39 °F water temperature).

The CO_2 absorbing canister is covered at the bottom by a packing pad which captures dust and helps compensate for settling. It is further captured by a stainless-steel mesh and tightened by two, hand-tight nuts. A colored O-ring at the top provides water-tight integrity, while two quick-release latches secure the canister to the canister case.

⚠ CAUTION

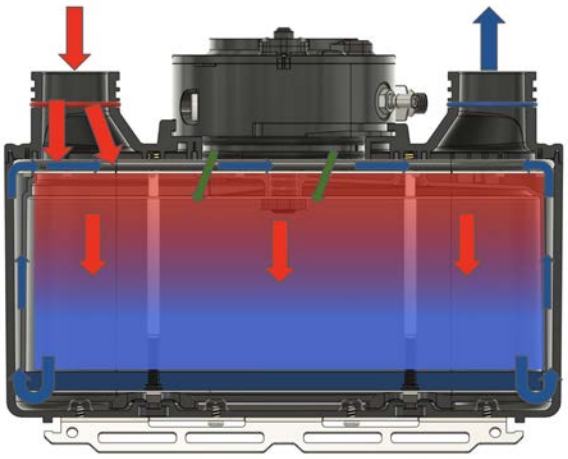
Scrubber Use

Exceeding the certified scrubber duration or using non-approved absorbents may lead to premature CO_2 breakthrough and risk of hypercapnia. The CO_2 absorbing canister is an axial flow scrubber holding 2.35 kg of Sofnolime™ 797. This is the absorbent tested and validated for use in the Symbios CM Rebreather. The absorbent must be filled evenly to the engraved fill line marking. The

dense foam spacer is designed for dust filtration and helps compensate for settling.

3.2.3 Gas Flow Path

– Exhaled gas enters through the left inlet port (red) from the exhalation counterlung.
– The gas passes through the absorption bed where CO_2 is chemically removed.
– Oxygen injection ports on the sampling chamber allow both automatic and manual O_2 addition on the exhalation side of the loop.
– The scrubbed gas exits the canister at the bottom, travels upward along the external side of the canister, and enters the inhalation path.
– Oxygen sensors sample the gas within the chamber before it continues through the right outlet port (blue) into the inhalation counterlung.



3.3 Breathing Loop

The breathing loop of the Symbios CM Rebreather consists of a Dive Surface Valve (DSV) and two rubber corrugated hoses with quick-lock fittings. The Symbios CM Rebreather breathing loop is designed for ease of assembly, inspection, and cleaning, while maintaining compliance with CE performance requirements.

– The corrugated hoses connect to the top part of the combination ADV/BOV using quick-lock couplings.
– Each connection point uses color-coded O-rings to distinguish between inhalation and exhalation sides.
– Fitting geometry prevents accidental misconnection of inhalation and exhalation hoses.

3.3.1 Dive Surface Valve (DSV)

– The DSV contains directional one-way mushroom valves, ensuring right-to-left gas circulation only.
– A lever control located at the center of the DSV allows the diver to switch between:
  – Closed (surface position) – isolating the loop.
  – Open (dive position) – allowing gas circulation during the dive.

3.4 Counterlungs

The Symbios CM Rebreather is equipped with asymmetrical 3D counterlungs designed to minimize work of breathing in all orientations while maintaining optimal CO_2 absorption performance.

The counterlungs are connected to the ADV/BOV and scrubber canister via quarter-turn bayonet couplings, allowing quick removal for rinsing and reassembly. Single-action, fail-safe couplings ensure secure connection, correct placement, and straightforward operation of the breathing loop and Dive Surface Valve (DSV).

Manufactured from wear-resistant material with a protective external coating and fused through an RF welding process, the counterlungs are durable and quick-drying. Color coding and laser-engraved identifiers at the bayonet couplings ensure correct identification, alignment, and assembly.

The counterlungs balance inhalation and exhalation volumes, reducing hydrostatic loading and improving breathing comfort. An over-pressure/dump valve (OPV), integrated into the exhalation counterlung, protects against over-pressurization and allows manual water drainage. The exhalation counterlung also incorporates an internal snorkel that functions as a water trap, reducing water intrusion. The 3d shape allows much faster drying and reduced risk of contamination.

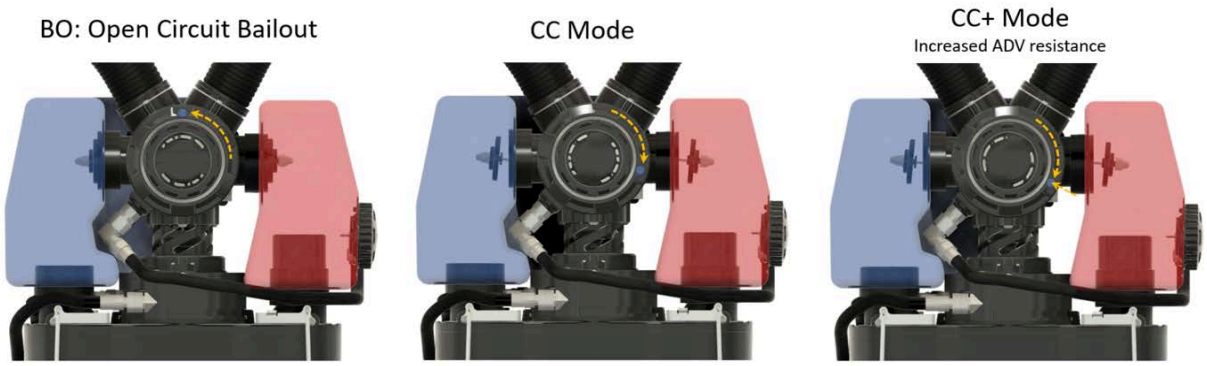
3.4.1 Counterlung Use

- Improper assembly or failure to secure bayonet couplings may cause loop leakage or flooding.
- Counterlungs must be rinsed and fully dried after each dive to prevent microbial contamination.
- The OPV must be checked during pre-dive tests to confirm proper venting and drainage function.

⚠ WARNING

Improper assembly of the breathing loop or failure to check bayonet couplings before diving may lead to loop leakage or flooding, resulting in serious risk to the diver.

3.5 Combination ADV/BOV



The Symbios CM Rebreather is equipped with a patented Automatic Diluent Valve (ADV) / Bailout Valve (BOV) which also functions as a manual diluent addition valve and an OC/CC selector switch. This unique design combines the automatic diluent valve (ADV) and bailout valve (BOV) into a single, lightweight, streamlined unit while maintaining CE safety compliance.

- Mode Switching: The front bezel allows seamless switching between closed-circuit (CC) and open-circuit (OC) modes with a half-turn rotation.
- Reduced Jaw Fatigue: The valve body is mounted within the rebreather unit rather than at the mouthpiece, reducing loop weight at the diver's mouth and improving comfort, head mobility, and long-duration ergonomics.
- Counterlung & Loop Connections: The top section provides mounting points for both counterlung hoses. Color-coded O-rings (red = exhalation, blue = inhalation) ensure correct orientation and secure assembly.
- Breathing Functions:
    - In OC mode, the front face functions as a second-stage regulator, delivering gas when the membrane is pressed. In case of CCR malfunction, the BOV enables immediate transition to open-circuit breathing from the diluent cylinder.
    - In CC or OC mode, the mechanism supplies on-demand diluent when triggered by inhalation.
    - In CC mode the ADV automatically injects diluent to equalize loop volume with ambient pressure. The diver may manually add diluent through the BOV or MAV as required for buoyancy, loop flushing, or PO_2 management.
- Diluent Feed: A front-left diluent port, fitted with a quick-disconnect hose, connects to the selected diluent or bailout cylinder.
- Exhaust & Relief:
    - In OC mode, a one-way mushroom valve vents exhaled gas to the environment.
    - In CC mode, a spring-loaded cup seal closes the exhaust. If internal pressure exceeds spring tension, the seal lifts to act as a secondary OPV, providing backup to the exhalation counterlung valve.
- Mounting: The lower section supports the assembly and secures it to the CCR head via a quarter-turn bayonet mount.

3.5.1 Selector Bezel

A rotating bezel on the front face switches the unit between OC and CC modes.

- Clockwise rotation = CC mode.
  - The valve functions as an ADV, injecting diluent automatically to equalize loop volume during descent. The diver may also manually add diluent by pressing the front face of the regulator, like purging an open-circuit second stage regulator

- Counterclockwise rotation = OC mode.
  - With a half-turn of the bezel, the diver can instantly switch to open-circuit breathing from the diluent cylinder. This provides immediate access to a safe breathing source in the event of rebreather malfunction.
  - Pressing the bezel button while in CC mode allows an additional rotation, which increases the ADV cracking pressure in CC+. This requires a greater pressure differential to trigger diluent addition, preferred by some divers for improved loop volume control. The system resets when the bezel is rotated back counterclockwise.
  - The CC+ position has an increased breathing resistance and elevated cracking pressure to avoid unwanted diluent injection. Increased resistance reduces injections of mixes with low oxygen content. This is especially during decompression where elevated PO_2 levels are important and dilution unproductive. This setting also makes it easier to quickly reach minimum loop volume which is desirable while diving where buoyancy control and predictable injections are critical.

⚠ WARNING

The CC+ position increases cracking pressure and increases the breathing resistance of the ADV. The preferred position during diving is CC.

3.5.2 Electronic Integration

- The bezel position (OC or CC/CC+) is transmitted wirelessly to the Symbios electronic controller, handset, and HUD.
- This ensures the diver is always aware of the breathing mode, reducing the risk of operational errors in critical situations.

⚠ WARNING

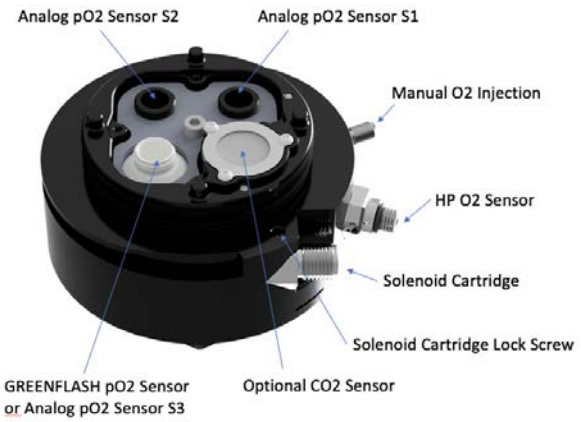
ADV/BOV function and position must be included in all pre-dive functional checks. Divers should always independently verify OC/CC position. Incorrect switching between OC and CC may lead to inadequate gas supply, posing a risk of hypoxia or hypercapnia. Partial selection between operating modes may result in excess gas use.

⚠ CAUTION

Diluent Safety

- The selected diluent must be suitable for the planned depth and dive profile:
- Air – CE-certified to a maximum operating depth of 40 m/130 ft.
- Trimix – CE-certified to a maximum operating depth of 100 m/330 ft.
- The gas mixtures required by CE testing are not intended as planning advice. Divers must make these choices independently. Use of inappropriate diluent mixtures may cause nitrogen narcosis, hypoxia, or oxygen toxicity.
- The diver must verify the correct gas mixture before every dive, in compliance with unit protocols, recognized training standards, and personal responsibility for dive planning.

3.6 Rebreather Head and Electronics



The Symbios CM Rebreather head is the central component of the system, containing critical monitoring and control features.

- A proprietary Symbios Wi-Dive™ wireless protocol provides real-time data transmission between the CCR head, the Symbios Handset, and the HUD.
- Underwater, magnetic transmission ensures reliable, low-latency communication within ~1 m range.
- On the surface, BT connectivity supports log download, firmware updates, and configuration via the Halcyon Dive App.
- Independent electronics - Controller and Sentinel (monitors operations).
- User replaceable Oxygen solenoid valve.
- Onboard oxygen high-pressure sensor.
- Dual power supply system.
- Two galvanic oxygen sensors and one Halcyon GreenFlash™ Optode oxygen sensor.
- Wet contact sensor.
- CCR button for diver interface.
- Symbios Wi-Dive™ antennas for wireless communication.
- Combined battery charging / USB-port connector.
- Oxygen injection ports (automatic and manual) are integrated into the CCR head perimeter and sealed with dual O-rings. Inlet ports feed gas to the solenoid, manual addition valve, and onboard O_2 pressure sensor.

3.6.1 CCR Head Location and Operation

The CCR head is secured on top of the CO_2 absorption canister using a ¼-turn bayonet mount. Once mounted, the space between the CCR head and the canister forms the gas sampling area for inspired gas analysis.

- Oxygen is supplied automatically via the solenoid in accordance with the chosen setpoint (0.5 – 1.4 bar).
- The diver can also add oxygen manually via the MAV when required.
- Redundant oxygen sensors provide cross-referenced monitoring to detect deviations or sensor failures.
- A CCR control button allows the diver to:
    - Power on/off electronics.
    - Enter oxygen calibration mode.
    - Select or switch PO_2 setpoints.

` _ Acknowledge or mute vibration alarms.

_ Integrated vibration alarms warn the diver of unsafe PO_2 levels, low power, or system errors.
_ A status LED provides feedback on operating mode and battery state.

LED Indicator Modes – Quick Reference

Mode	Behavior	LED color
Normal mode	blinking	BAT >70% 30%<BAT<70% BAT<30%
USB mode	permanent	BAT >70% 30%<BAT<70% BAT<30%
Calibration	blinking	Magenta
Firmware update	1x blink per update	White
Bluetooth connected	blinking	Blue

3.6.2 Powering on the Symbios CM Rebreather

The Symbios CM Rebreather can be activated in several ways, depending on its current operational state.

_ When the unit is in standby mode (powered down but with the CCR button still responsive), it can be switched on using any of the following methods:
_ Manual Activation via Button:
Press and hold the CCR button for approximately 3 seconds. This powers on the CCR electronics, making the head unit ready to operate and to communicate with the Symbios Handset or HUD.
_ Automatic Activation via Oxygen Supply:
Connect an oxygen cylinder to the CCR head and open the valve. The presence of oxygen pressure will automatically activate the CCR electronics, preparing the head unit for operation and communication with connected devices.
_ Automatic Activation via Loop Assembly:
When the unit is assembled with the ADV/BOV combination mounted on the head, rotating the rotary bezel to the "CC" (Closed Circuit) position will automatically switch on the CCR electronics. The system will then be ready for use and able to connect to the Symbios Handset or HUD.

3.6.3 Switching the Unit Off

To safely power down the Symbios CM Rebreather electronics, the following steps must be completed in order:

_ Rotate the OC/CC bezel to the OC (Open Circuit) position.

– Close the oxygen supply valve to stop gas flow to the CCR head.

– Purge the oxygen line using the Oxygen Manual Addition Valve (O_2 MAV) to ensure the line is fully depressurized.

Once all three steps are completed, the CCR electronics will automatically enter sleep mode after 60 seconds. This delayed shutdown ensures all components are safely deactivated and prevents unintentional reactivation due to residual pressure or loop configuration.

NOTICE

Always verify that the system has fully powered down before storage or transport. Residual pressure or an incorrect loop position may delay or prevent shutdown and discharge the battery.

3.6.4 Standby Mode

The Symbios CM Rebreather is equipped with a power conservation feature that automatically reduces energy use when the system is not actively being used on the surface. In this state, the electronics remain active but operate at significantly reduced power consumption to preserve battery life.

The unit will enter standby mode if it remains switched on at the surface without user interaction for more than 1 hour. Any subsequent user action—such as pressing the CCR button, adjusting the bezel, or connecting gas supply—will return the system to its normal operating mode.

NOTICE

Standby mode conserves power but does not replace proper shutdown procedures after use. Always switch off the unit following the prescribed steps when storing or transporting the CCR.

3.6.5 Travel Mode

The Symbios CM Rebreather includes a Travel Mode designed to prevent accidental activation during transport. When enabled, the CCR button becomes inactive, ensuring the system remains secure and conserves battery life.

To place the unit in Travel Mode:

1. Press and hold the CCR button for more than 30 seconds.
2. The CCR head will confirm entry with a series of three long vibrations.
3. The CCR button will be deactivated at the next sleep cycle.
4. After 60 seconds, the unit will automatically transition into Sleep Mode.

NOTICE

Travel Mode should be activated when transporting the unit to avoid inadvertent activation and battery drain.

3.6.6 Exiting Travel Mode

To reactivate the CCR and deactivate Travel Mode:

1. Connect the unit to an oxygen tank.
2. Open the oxygen supply valve.
3. The CCR electronics will power on and the CCR button will be re-enabled.

3.6.7 Charging the CCR Head Battery

To recharge the Symbios CM CCR head battery:

1. Connect the provided charging/connection cable to a suitable USB power source or approved charger.
2. Place the magnetic charging adapter onto the magnetic charging port on the CCR head. This will activate charging mode.

When charging begins, the status indicating LED will illuminate to display the current battery level:

- **Green**: Battery between 100% and 70%
- **Yellow**: Battery between 69% and 30%
- **Red**: Battery below 30%

To optimize efficiency, the LED will automatically switch off after one minute.

Battery level can be checked at any time during charging by pressing the CCR button for approximately 3 seconds. For a more precise reading, a paired Symbios Handset or HUD may be used to display the battery percentage.

⚠ WARNING

Only use the approved Symbios charging cable and adapter. Using non-approved chargers may cause overheating, reduced battery life, or damage to the CCR electronics.

3.6.8 Communicating with the CCR Head

The Symbios CM Rebreather can connect to a variety of devices, including wireless links to the Symbios Handset or HUD, BT pairing with the Halcyon App, and by cable connection to a personal computer.

3.6.8.1 Pairing with the Halcyon App

Pairing the Symbios CCR Head with the Halcyon App extends the functionality of your system by providing a convenient and secure interface for configuration, updates, and dive management.

Key Features of the Halcyon App

- Settings Management – Adjust operational parameters such as setpoints, alarm preferences, and type of sensor in slot 3.
- Firmware Updates – Keep your CCR head,

HUD, and handset up to date with the latest improvements and safety enhancements.

_ Interactive Checklists – Complete a guided, step-by-step procedure with built-in reminders to ensure equipment readiness.

_ Dive Log Integration – Review, organize, and export your previous dives directly from the app, including sensor data, setpoint history, and alerts.

_ Calibration – Adjust calibration parameters, view millivolts, and track sensor history.

_ Cloud Backup (optional) – Store dive data securely and access it from multiple devices.

Pairing Procedure

_ Ensure the Symbios CCR Head is powered on.

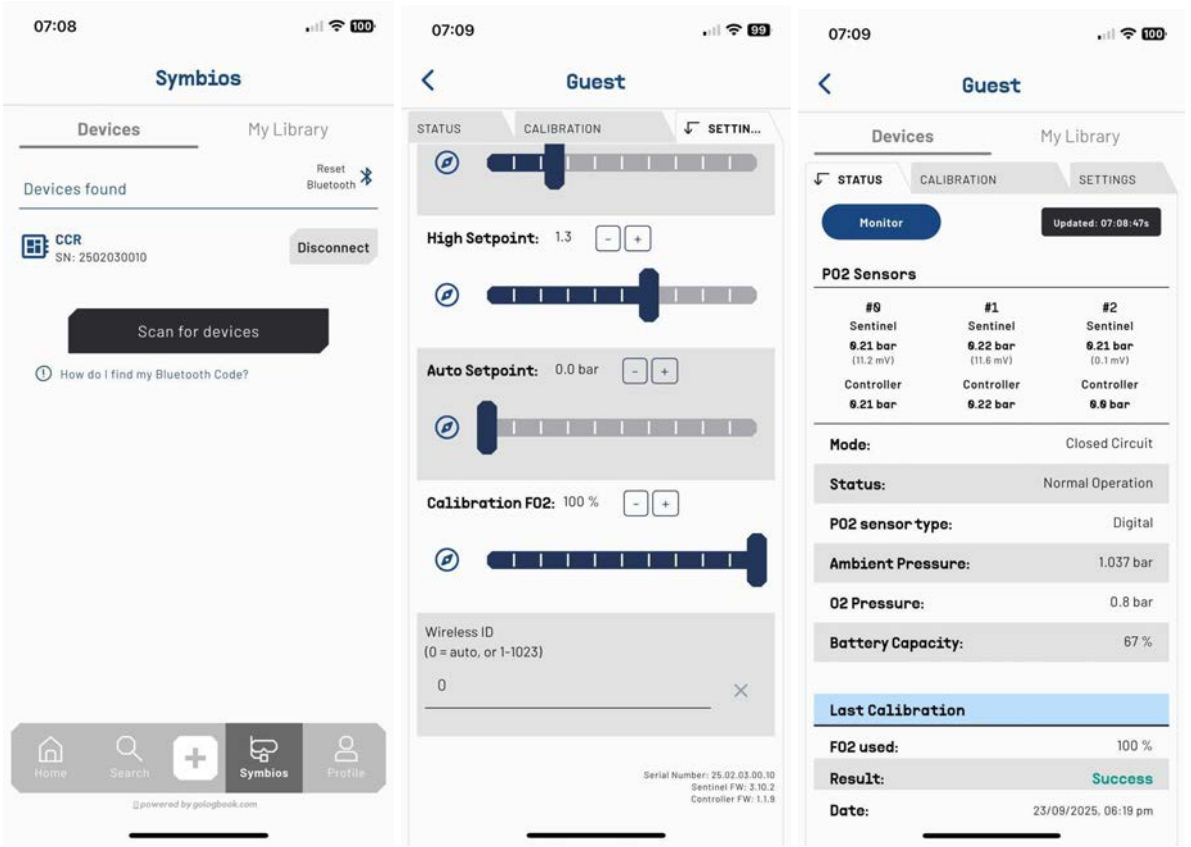
_ Enable BT on your mobile device.

_ Open the Halcyon App and select Pair Device.

_ Choose your Symbios CCR Head from the list of available devices.

_ Enter the pairing code as the first four and last two digits (total of six digits) of the serial number on the CCR Head.

_ Once paired, the connection will be stored for automatic reconnection in future sessions.



⚠ CAUTION

– Only pair with the official Halcyon App from Apple App Store or Google Play.
– Always complete relevant pairing before beginning dive operations.
– Ensure that all critical settings are configured and confirmed before descent.
– Always confirm the correct device is selected before pairing. Incorrect pairing may interfere with data transmission and system monitoring.

⚠ CAUTION

Battery Notice

Leaving the Halcyon App active while paired to a device may maintain a live connection and may deplete the device battery. Close the app or pairing window or disconnect from the device when pairing is not required.

3.6.8.2 Pairing the CCR Head with a Handset or HUD

Communication between the Symbios CM CCR head and a Symbios Handset or HUD requires an initial pairing process. Once paired, the CCR head will transmit operational data wirelessly to the selected device. Please note this communication is one-way. The Handset/HUD does not transmit information to the Head.

Pairing Procedure

1. Power On Devices
   Switch on both the CCR head and the Symbios device (Handset or HUD) to be paired.

2. Avoid Electromagnetic Interference
   Perform pairing in an area free from strong sources of electromagnetic interference.

⚠ WARNING

An active DPV battery charger or similar device may cause interference if the CCR head and Symbios device are placed nearby.

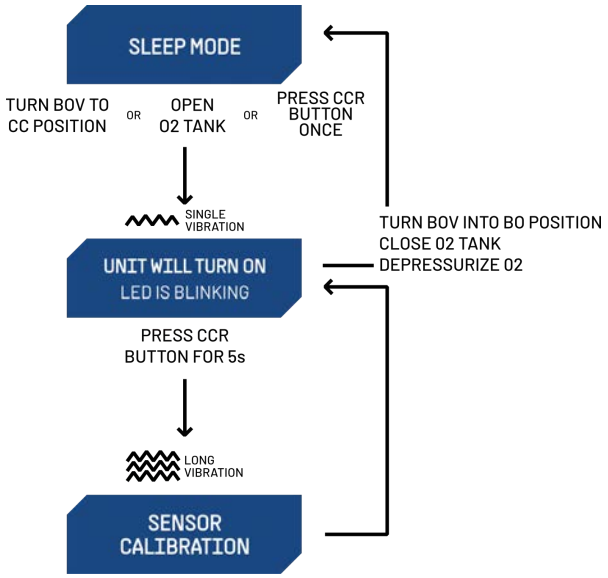
3. Confirm Device Mode
   Ensure the Symbios device is set to CCR Diving Mode.

4. Navigate to Pairing Menu
   On the Symbios device, enter the Menu → Settings → Pairing → CCR Interface.

5. Initiate Pairing
   Within the CCR Interface, press the top button on the Symbios device to pair your CCR head. If another head is already paired, you must first press the button to unpair and then pair to the new CCR head. You can only be paired to one CCR Head at a time.

6. Confirm Pairing
   Once pairing is complete, the Symbios device will display the ID number of the connected CCR head.

7. Verify Data Reception
   Exit to the main display and confirm that the Symbios device is receiving live data from the CCR head.



3.6.8.3 USB Mode

The Symbios CM Rebreather Head can be connected to a PC using the provided charging/connection cable. This allows the user to perform firmware updates or access the unit's internal memory logs for review and diagnostics.

To enter USB mode:

1. Connect the USB end of the cable to a suitable USB port on your computer.
2. Attach the magnetic charging adapter to the magnetic connection port on the CCR Head.
3. The CCR electronics will power on automatically, and the unit will appear on your computer as a removable storage device (external drive).
4. Open the drive using your operating system's file explorer to view log files. The Blackbox file may be copied and sent to the Halcyon support team for diagnostic review.

⚠ CAUTION

- Always properly disconnect (eject/dismount) the drive before removing the cable.
- Use the operating system's "Safely Remove Hardware" or "Eject" function to prevent corruption.
- Do not modify or delete firmware or system files on the CCR Head, as this may disable or damage the system.
- Never disconnect the cable while a firmware update is in progress.
- Improper removal may corrupt or permanently damage the unit's internal memory drive.

⚠ WARNING

Do not attempt to dive while the CCR is in USB mode. Ensure all files are safely closed and the device is properly disconnected before resuming normal operation.

3.7 Oxygen Control Electronics / Symbios Guardian r-OS™

The Symbios Guardian r-OS™ (Rebreather Operating System) provides advanced functionality, redundancy, and enhanced diver protection through intelligent oxygen control, layered protection strategies, and clear user alerts.

3.7.1 System Architecture

- Dual independent controllers monitor PO_2 from three sensors and operate the oxygen solenoid valve.
- The primary controller manages PO_2 setpoints and transmits data via the Symbios Wi-Dive™ protocol.

– The Sentinel secondary controller independently monitors PO_2, power levels, ambient pressure, and the onboard O_2 pressure sensor.

– Linked by an I^2C bus, the two systems form a triple-redundant architecture, broadcasting data through independent antennas for continuous, fail-safe feedback.

– All control electronics are integrated in the CCR head, managing sensors, solenoid operation, and wireless communication.

3.7.2 Control & Protection Functions

– Calculates the average of three sensor values and compares them to the diver's selected setpoint.

– Stable PO_2 regulation via a fine-tuned solenoid control algorithm.

– Descent protection: pauses injection during descents >10 m/min/33 ft/min to avoid PO_2 spikes.

– Hyperoxia protection pauses injection if any sensor reads >1.4 bar (or >1.5 bar when setpoint is 1.4 bar).

– Hypoxia protection: if two sensors read ≤0.3 bar, the solenoid injects oxygen for a fixed interval regardless of the third sensor.

– Automatic sensor exclusion ignores any sensor reporting ≤0.02 bar to prevent erroneous input.

3.7.3 Communication & Alerts

– Symbios Wi-Dive™ protocol enables reliable, Sensor Comparison real-time wireless data transmission between the CCR head, handset, and HUD.

– Integrated visual and vibration alarms warn of unsafe PO_2 levels, sensor deviations, solenoid faults, low power, or other system errors.

This operating system places the Symbios CM Rebreather at the forefront of current rebreather technology, offering divers a highly reliable, redundant, and connected platform designed to meet the demanding requirements of both recreational and technical diving.

NOTICE

User Responsibility

While the Guardian r-OS™ provides advanced safeguards, diver vigilance, correct training, and adherence to operating procedures remain essential for safe rebreather use.

3.7.4 Oxygen Sensors

The Symbios CCR uses a combination of electrochemical oxygen sensors and the GreenFlash™ solid-state sensor to monitor PO_2 in the breathing loop.

Electrochemical sensors generate an electrical current, measured in voltage, which is proportional to oxygen partial pressure. The GreenFlash™ sensor uses optical fluorescence quenching to deliver a digital signal. Using both technologies provides redundancy, stability in varying conditions, and improved long-term reliability.

Feature	Electrochemical O_2 Sensor	GreenFlash™ Solid-State O_2 Sensor
Signal Type	Analog signal in mV	Digital output
Service Life	~12 months (consumable)	Up to 5 years
Environmental Sensitivity	Affected by humidity, age, and calibration drift	Stable in high-humidity CCR loop
Calibration	Requires frequent user calibration	Factory calibration with correction factor applied during calibration of electrochemical cells
Auxiliary Data	None	Battery level, diagnostics
Response Time	Very Fast	Fast (t63~2 s)
Failure Modes	Aging, current limitation, false readings, non-linearity	Optical sensor spot bleaching, battery depletion

⚠ CAUTION

– Always verify correct calibration before diving, especially with changing conditions.
– Expired, damaged, or uncalibrated sensors can result in false PO_2 readings.
– Failure to care for and calibrate sensors can lead to hypoxia or hyperoxia.

3.7.4.1 Sensor Positioning

- Slots 1 and 2: Electrochemical (galvanic) oxygen cells.
- Slot 3: Halcyon GreenFlash™ Optode sensor.

- Slot 3 may be adjusted to use an electrochemical (galvanic) oxygen cell. This adjustment can be done by pairing the CCR head with the Halcyon app and changing the appropriate setting.

3.7.4.2 Halcyon GreenFlash™ Optode

Halcyon GreenFlash™ Optode O_2 Sensor

The Halcyon GreenFlash™ Optode is a solid-state O_2 Sensor that employs a fluorescent dye-coated membrane excited by a green LED. It is often reThe dye emits light, which is quenched in the presence of oxygen; the higher the partial pressure of O_2, the lower the intensity and lifetime of the signal. A high-speed optical detector captures the fluorescence, applies Fast Fourier Transformation (FFT) analysis with temperature compensation, and calculates PO_2 values based on factory calibration data. This design provides a stable, calibration-locked measurement of oxygen partial pressure.

⚠ CAUTION

Bright ambient or fluorescent light can interfere with readings. Always use the sensor inside the protective housing of the

measurement system or in a light-shielded environment.

The Symbios CM Rebreather is configured with a GreenFlash™ oxygen sensor installed in slot 3 of the CCR head. It delivers a digital PO_2 signal with auxiliary data (e.g., battery level and temperature).

Key Features

- Humidity stable: Less affected by moisture than galvanic sensors, ensuring reliability in CCR breathing loops.
- Low power draw: Powered by a CR2477 coin-cell battery (>900 mAh).
- Operating modes:
  - Sleep Mode – inactive when not installed; checks every 20 s.
  - Standby Mode – pilot measurement every 15 s; activates if PO_2 > 0.3 bar.
  - Measurement Mode – measurement every 2 s, outputs analog or digital data; reverts to Standby when PO_2 < 0.3 bar for one hour.
- Measurement range (PO_2): 0.1 – 2 bar
- O_2 fraction range: 10–100%
- Response time: ~2 s (t63)
- Operating temperature: 0–40 °C/32–104 °F
- Storage temperature: -10–50 °C/14-122 °F
- Accuracy: ISO 80601-2-55:2018 compliant
- Can operate in analogue mode, producing ~10 mV at 21% O_2.

Output Modes

The Halcyon GreenFlash™ Optode may operate in either digital or analog output mode.

To configure the Halcyon GreenFlash™ Optode for analog operation:

- Carefully remove the battery.
- Wait 30 seconds.
- Replace the battery and reassemble the cell.
- The Halcyon GreenFlash™ Optode will test the circuit into which it is installed.
- Install the Halcyon GreenFlash™ Optode in an analog-designated location/system.
- The cell will test the system and lock into this mode as long as it maintains battery.

To reconfigure the Halcyon GreenFlash™ Optode for digital operation:

- Carefully remove the battery.
- Wait 30 seconds.
- Replace the battery and reassemble the cell.
- Verify slot three is configured for a digital cell via the Halcyon app.
- Place the sensor in slot three of the CCR Head.
- The cell will test the system and lock into this mode as long as it maintains battery.

NOTICE

Slot 3 of the Symbios CM Rebreather Head is configured for a digital signal. This may be changed by pairing the CCR Head with the Halcyon app and resetting the slot to accept an analog cell.

⚠ CAUTION

- Do not expose to direct sunlight (risk of bleaching/damage to sensor spot).
- Do not operate in bright light (risk of amplifier overload → incorrect readings).
- Do not operate in fluorescent light (may disturb readings).

_ Accuracy may be reduced after exposure above 40 °C/104 °F.

_ Operation below 10 °C/50 °F increases battery consumption.

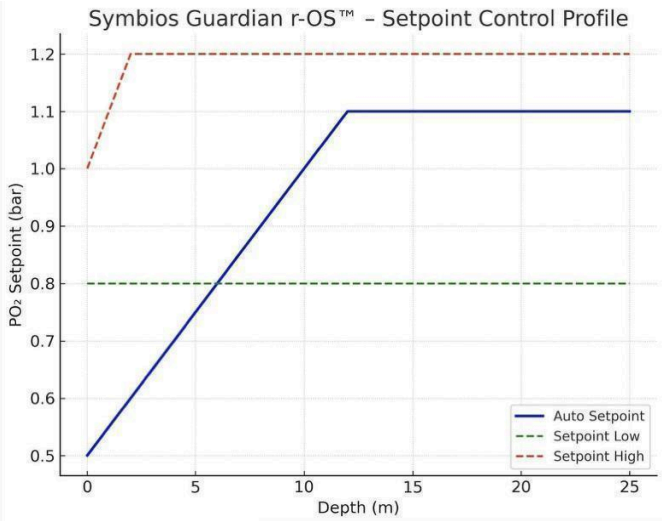
3.7.5 Oxygen Partial Pressure Setpoints

The Symbios CM Rebreather provides three selectable PO_2 setpoints:

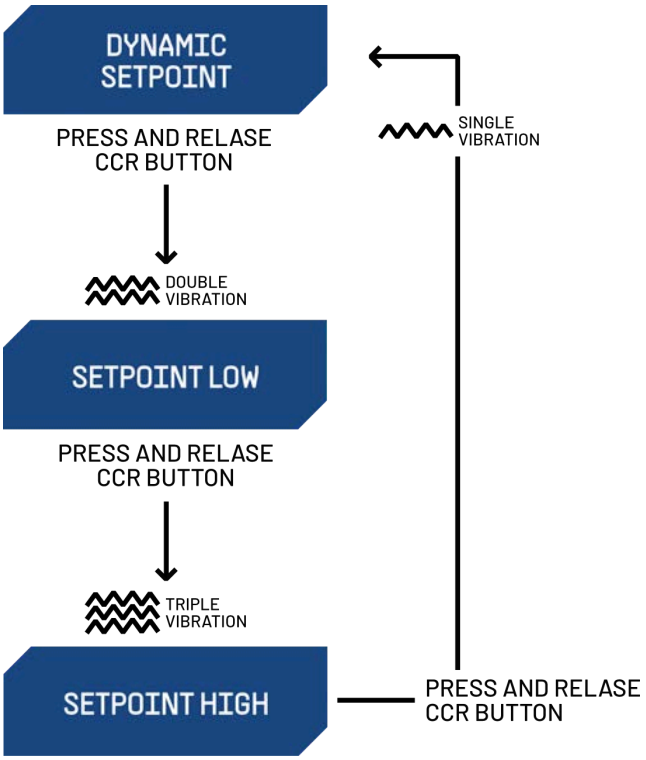
_ Dynamic Setpoint – Maintains ~50% oxygen fraction during descent, adjusting until the chosen maximum PO_2 is reached (0.8–1.2 bar). During ascent, switches back to FO_2 maintenance. Confirmed by one vibration sequence.

_ Low Setpoint – Maintains a user-selected PO_2 between 0.6–1.0 bar. Confirmed by two vibration sequences.

_ High Setpoint – Maintains a user-selected PO_2 between 1.1–1.4 bar. Confirmed by three vibration sequences.



Setpoints cycle sequentially with each press of the CCR button.



3.7.6 Wireless Connection / Symbios Wi-Dive™

The Symbios CM Rebreather uses BT communication on the surface to connect with the Halcyon Dive App, enabling data download and configuration.

Underwater, the unit transmits data via the proprietary Symbios Wi-Dive™ protocol, based on magnetic transmission, effective up to ~1 m/3 ft range.

The system ensures:

_ High data rate and low latency.

_ Redundant transmission for reliability.

_ Verification protocols to minimize error.

This provides divers with uninterrupted monitoring of CCR parameters without the limitations of tethered cables.

3.7.7 Active Warning Device

The Symbios CM Rebreather Head incorporates an active warning system in accordance with EN 14143 requirements. A vibrating motor, positioned at the diver's chest, provides immediate tactile feedback in the event of dangerously high or low oxygen partial pressure. This vibration is paired with visual red warning indicators on the handset display, ensuring redundancy across multiple sensory channels.

The chest placement of the vibrating motor makes the alarm virtually impossible to ignore, while its intensity allows it to be felt by the diver and, in many cases, even heard by nearby divers at distances of up to 10 m/33 ft.

Together, these multi-modal active alarms (tactile, visual, and audible) substantially reduce the likelihood of a diver overlooking or disregarding critical oxygen warnings, thereby providing a significant increase in operational safety and compliance with CE/EN standards.

Vibration Alarm System

The inbuilt vibrator motor provides tactile feedback, serving as an active warning device to alert the diver in critical situations. It also provides confirmation feedback during system operations such as power-on and calibration.

Vibration Signals and Meanings

Vibration Type	Pattern	Meaning
Short single vibration	–	Auto (Dynamic) setpoint is selected
Two short vibrations	– –	Setpoint low is selected
Three short vibrations	– – –	Setpoint high is selected
Continuous vibration signals	– – – – – – – – – –	Too high or too low PO_2
Very short vibrations	. .	Battery is low (5% < BAT < 15%) *
Single long vibration	----	Start of PO_2 calibration
Three long vibrations	---- ---- ----	CCR Button deactivated**

NOTICE

Battery Capacity Alerts

When the battery capacity drops below 15%, the diver will receive a series of very short vibration pulses to indicate low charge.

_ If the charge falls below 5%, this alert is suppressed to conserve the remaining capacity.

_ When the low-battery alert is suppressed, users must pay close attention to the battery status via handset/HUD to ensure safe operation.

NOTICE

The vibrator motor also provides feedback when the CCR head is switched on and during calibration procedures.

3.8 Symbios CM Rebreather Oxygen Supply System

The Symbios CM Rebreather oxygen supply system is designed to deliver oxygen to the breathing loop safely and in compliance with EN 14143:2013 requirements. The system consists of:

_ Oxygen Cylinder – mounted to the base of the rebreather canister; must be certified for oxygen service in accordance with national standards of the country of use.

_ Oxygen Regulator with Integrated MAV – reduces cylinder pressure to intermediate pressure and allows manual addition of oxygen to the loop.

_ Solenoid Valve – electronically controlled, provides automatic oxygen addition to maintain the diver-selected PO_2 setpoint.

_ Oxygen Sensors – two electrochemical sensors and one Halcyon GreenFlash™ Optode, digital sensor installed in the CCR head to continuously measure the partial pressure of oxygen in the breathing loop. It is possible to instead use three electrochemical sensors.

_ Electronics Module – monitors sensor output, controls the solenoid, and provides real-time PO_2 information via the Symbios handset and HUD.

⚠ WARNING

Oxygen System Safety

_ Only cylinders, valves, and regulators approved for oxygen service must be used.

_ The HP connection to the head is oxygen clean and the diver should not remove this hose to avoid contamination. The inline flow restrictor on the HP hose should also not be removed. Hydrocarbon contamination, improper lubrication, or non-certified components may cause fire or explosion.

_ The diver must confirm correct operation of the solenoid, MAV, and all oxygen sensors during pre-dive checks.

3.8.1 Oxygen Pressure Regulator

The Symbios CM Rebreather is equipped with a first stage oxygen regulator that reduces cylinder pressure to an intermediate pressure (IP) suitable for system operation.

_ Non-balanced piston design, offering reliable operation, reduced maintenance intervals, and simplified servicing.

_ CE version is fitted with a M26 thread for oxygen cylinder connection. The international version is normally fitted with DIN thread or adjusted as required within a particular

country.

- Intermediate pressure should be maintained between 7 and 8 bar at 200 bar supply pressure.
- Integrated manual oxygen addition valve (MAV) allows the diver to control oxygen addition directly into the loop.
- Adjustable over-pressure relief valve (OPV) set to open at 9 bar, protecting the system from regulator failure or over-pressurization.
- Connections
    - Three oxygen supply hoses exit the regulator:
        - One to the oxygen solenoid valve.
        - One to the high-pressure oxygen sensor.
        - One to the manual addition valve.

⚠ WARNING

OXYGEN FIRE / EXPLOSION RISK

Oxygen handling poses serious fire and explosion hazards. Strict adherence to the following rules is mandatory:

- All components connected to the oxygen regulator must remain oxygen-cleaned and oxygen-compatible. This includes hoses, hose connections, fittings, HP hoses, and LP hoses.
- Connection or disconnection of oxygen hoses may only be performed by trained personnel qualified in oxygen-clean servicing.
- Never connect or disconnect hoses in a contaminated or non-oxygen-clean environment. Hydrocarbons, grease, dust, or particles may act as ignition sources.
- Never use an oxygen cylinder warmer than 30 °C/86 °F. High temperature increases ignition risk.
- Always pressurize the system slowly. Note: *Opening a valve slowly is not the same as pressurizing slowly.* Ensure gradual pressurization to avoid adiabatic heating.
- Fully depressurize hoses before disassembly. Opening or removing fittings under pressure may cause fire or explosion.
- Only approved lubricants and sealing materials may be applied to oxygen service components. Unapproved materials may ignite under oxygen exposure.

Failure to comply with these requirements creates a severe risk of fire, explosion, serious injury, or death.

NOTICE

The manufacturer accepts no responsibility or liability if these rules are not strictly followed.

3.8.2 Onboard Oxygen Cylinder

The Symbios CM Rebreather must be equipped with a cylinder certified for oxygen service and sized appropriately for the intended dive duration.

Mounting:

- The cylinder is secured to the mounting bracket located at the base of the CO_2 canister case.
- Quick-fastening straps hold the cylinder firmly in place for both operational use and transport.

⚠ CAUTION

Oxygen cylinders

- Only use cylinders approved and marked for oxygen service in compliance with local and CE regulations.

– Hydrocarbon contamination or incorrect cleaning procedures may result in fire or explosion.

Oxygen feed hoses and especially HP hoses should not be disconnected from the CCR head as this risks introducing contamination and encouraging combustion.

3.9 Monitoring Devices

3.9.1 Symbios Manuals

The following sections provide only a general overview of the associated devices. These descriptions are not intended to replace the detailed operating instructions supplied with each device.

All divers must carefully read, understand, and be fully familiar with the individual user manuals before use. Failure to follow the specific instructions, warnings, and limitations described in the respective manuals may result in misuse of equipment, increased operational risks, serious injury, or death.

For safe integration with the Symbios CM Rebreather, it is the diver's responsibility to ensure that each device is used strictly in accordance with its manufacturer's requirements and within the limitations defined in the relevant standards.

3.9.2 Electronics and Displays

The Symbios CM Rebreather is equipped with a redundant electronic monitoring and control system in compliance with EN 14143:2013. This system continuously monitors oxygen partial pressure (PO_2) in the breathing loop, regulates oxygen addition, and provides the diver with real-time information and alarms.

3.9.3 Symbios Handset & HUD Displays

The Symbios CM Rebreather transmits all operating parameters wirelessly via the proprietary Symbios Wi-Dive™ protocol to the Symbios Handset and Heads-Up Display (HUD) of the diver and/or dive buddies. These devices provide continuous monitoring of critical system information and enhance diver situational awareness.

– Handset – displays critical dive data including PO_2 values, setpoint, depth, dive time, decompression status, warnings, and system diagnostics.

– Heads-up display (HUD) – displays critical dive data including PO_2 values, setpoint, depth,

dive time, decompression status, warnings, and system diagnostics at eye level while providing additional redundancy over using a single Handset.

– Additional redundancy is available by adding more Handsets or HUDs and by the ability to read a dive buddy's transmission.

3.9.4 System Features

– Both the handset and HUD function as fully featured trimix-capable decompression computers and can be used independently when not diving with the Symbios CM Rebreather.

– The HUD and handset provide independent information pathways, ensuring redundancy.

– Divers must cross-check sensor data and act in accordance with training protocols in the event of sensor discrepancy.

– The system supports pairing with up to five Symbios tank Pods, allowing the display of gas pressure data from nine independent sources in addition to the onboard oxygen cylinder pressure.

– Data from the CCR (e.g., PO_2, setpoints, system status) is displayed in real time to assist the diver in monitoring the rebreather.

3.9.5 Display Parameters

All operating parameters can be wirelessly displayed on any paired Symbios Handset or Symbios HUD device.

Displayed parameters include:

– Individual O_2 sensor readings and average PO_2

– OC/CC operation mode

– Onboard O_2 pressure

– PO_2 setpoint

– Battery status of CCR head and GF sensor

– Wi-Dive communication status

– Active alarms and warnings

3.9.6 Important System Limitation

– The Symbios Handset and HUD are monitoring devices only.

– They are not part of the oxygen control system of the rebreather and cannot influence or regulate oxygen addition.

– Safe operation of the Symbios CM Rebreather depends on diver vigilance, adherence to training, and compliance with CE operating procedures.

3.9.7 Diver Responsibility

– Check PO_2 values regularly throughout the dive.

– Respond promptly to alarms.

– Continuously monitor both handset and HUD.

⚠ WARNING

The handset and HUD are display and monitoring devices, not automatic life-support controllers. Assuming otherwise may lead to false confidence in redundancy and increase the risk of hypoxia or hyperoxia. If sensors disagree or PO_2 deviates from safe limits, the system issues alarms that require immediate corrective action (e.g., switching to bailout or manually adding gas).

3.9.8 Symbios Handset

The Symbios Handset is a wrist-mounted, fully enabled dive computer capable of receiving and displaying Symbios Wi-Dive™ data.

Features:

- Symbios Wi-Dive™ wireless communication
- Depth, time, 3xPO_2, average PO_2, and decompression data
- Configurable information fields
- Strong vibration alert system
- Supports up to 9 pressure transmitters
- Bühlmann ZHL16C algorithm with gradient factors
- 3 CC and 5 OC gases, adjustable during the dive
- CNS and OTU tracking
- Compatible with air, nitrox, and trimix
- Manual or automatic switch between CC and OC
- Manual sensor exclusion from decompression calculations
- Tilt-compensated digital compass
- Dive log memory
- Fully integrated with Halcyon Dive App for logs, firmware updates, and settings sync

3.9.9 Symbios HUD

The Symbios HUD is a mask-mounted dive computer using Symbios Wi-Dive™. It projects a virtual display (20x20 cm/ 8" x 8") in front of the diver's eye without obstructing vision.

Halcyon recommends the HUD as the primary PO_2 monitoring device.

Features:

- Symbios Wi-Dive™ wireless communication
- Depth, time, 3xPO_2, average PO_2, and decompression data
- Configurable information fields
- Strong vibration alert system
- Supports up to 9 pressure transmitters
- Bühlmann ZHL16C with gradient factors
- 3 CC and 5 OC gases, adjustable during the dive
- CNS and OTU tracking
- Compatible with air, nitrox, and trimix
- Auto/manual switching between CC and OC
- Manual sensor exclusion
- Advanced PO_2 agreement algorithm for decompression and CNS calculations
- Tilt-compensated compass
- Dive log memory
- Fully integrated with Halcyon Dive App for logs, firmware updates, and settings sync

3.9.10 Handset and HUD Pairing with CCR Head

To pair a Symbios Handset or HUD with a CCR Head:

1. Turn on the CCR Head with the multi-function button.
2. Turn on the Handset or HUD.
3. Long press the top button to enter the menu.
4. Use the top or bottom button to navigate to Settings.
5. Long press the top button to enter.
6. Ensure the device is in CCR Diving Mode.
7. Navigate to Pairings Menu.
8. Select CCR Device.
9. Press and hold the top button to pair. The CCR wireless ID will appear once paired.

4 Outer Bag

The Symbios CM Rebreather uses a sturdy protective outer bag that shields the unit and provides multiple mounting points for diver attachment.

_ The bag features openings positioned for streamlined hose routing of oxygen and diluent supplies.

_ Provides easy access to the multi-function button on the CCR head.

⚠ WARNING

Buoyancy and Attachment

_ The Symbios CM Rebreather is not a buoyancy compensator (BC) and must not be used as one.

_ The Symbios CM Rebreather is not a harness for attaching the rebreather directly to the diver's body.

_ Divers must use a separate buoyancy compensator suitable for the intended dive profile.

_ The modular design of the Symbios CM Rebreather allows for different attachment methods; however, any chosen configuration must not compromise the safety, stability, or functionality of the rebreather system.

5 Unit Assembly And Preparation To Dive

The Symbios CM Rebreather is designed for straightforward assembly and preparation. However, the pre-dive checklist in Appendix A must always be followed to prevent mistakes that could result in incorrect function and pose a risk to diver safety.

NOTICE

Proper assembly, pre-dive checks, and adherence to maintenance intervals are critical to ensure safe operation of the Symbios CM Rebreather.

5.1 Loading the CO_2 Absorbing Material

- The CO_2 canister case holds the CO_2 absorbing canister.
- Place the CO_2 canister case on a flat surface with the top facing upward.
- Unlatch each of the two retaining levers, pull them upward and open.

⚠ WARNING

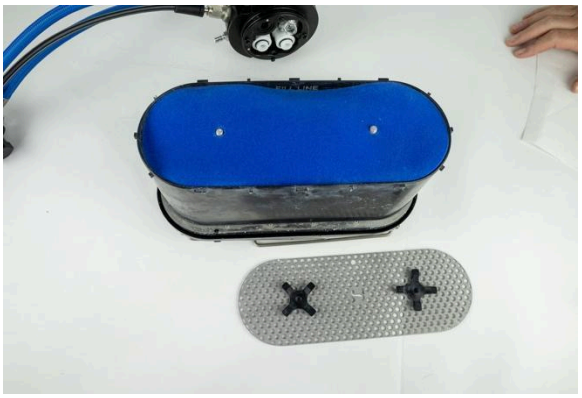
Be careful not to pinch your hand or finger when the lever moves toward the top fittings on the canister.

_ Use the lever action to carefully but firmly overcome the O-ring seal.

_ Lift the absorbing canister out of the canister case.

_ Turn the reservoir over so the mesh is facing upward.

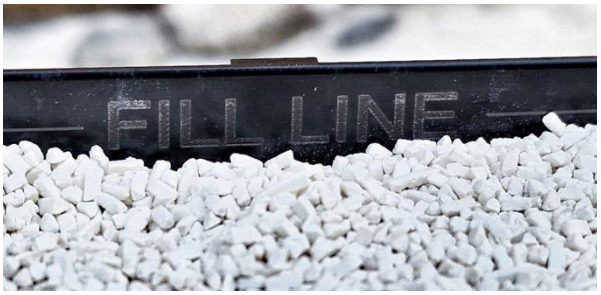
_ Remove the retaining nuts, mesh screen, and foam filter.



_ Verify the canister is clean and free of used absorbent or debris.

_ Fill halfway with approved CO_2 absorbent, tapping gently to distribute evenly.

_ Continue filling to the engraved fill line.



_ Inspect the foam filter; replace if damaged.

_ Reinstall the filter and seat the mesh so that it fits cleanly inside the housing.

_ Verify there is not overlap along the sides or corners.

_ Tighten the nuts to ensure a stable fit. DO NOT overtighten.

_ No loose material should be heard when the canister is shaken.

_ Inspect all O-rings for cuts, damage, or debris.

_ Insert the canister into the canister case, ensuring the inhalation side (blue O-ring) is on the right.

_ Ensure closure rods are seated properly under the canister and secure the top latches.

_ Place the canister into the outer bag, threading the oxygen cylinder straps through the bottom slots.

5.2 Preparing and Installing the CCR Head

5.2.1 Calibrating the CCR Head to the Oxygen Sensors

- Calibration must be completed before installing the CCR head.
- Use the supplied calibration cap and 100% oxygen.
- Inspect sensor dates and confirm oxygen purity.
- Verify secure connections to the solenoid feed hose, onboard oxygen sensor hose, and MAV hose.
- Attach the regulator to the calibration cylinder.
- Fit the calibration cap, power on the handset, then power on the CCR head.
- Verify communication and check battery levels.
- Slowly open the oxygen valve and hold the CCR button for 7 seconds.
- Confirm LED shows magenta and monitor calibration on the handset.
- When prompted, turn off the calibration cylinder and remove the calibration cap and expose sensors to air for linearity test (must stabilize at 0.21 bar ±0.02).
- Disconnect the LP quick-disconnect hose if preparing to assemble the unit.

5.2.2 Calibration Screens and Data

Entering Calibration Mode

- When calibration mode is activated, the Handset and HUD display CAL.
- The system begins injecting oxygen, and PO_2 values rise as calibration proceeds.

Displayed Values

- Analog Cells (mV Readings)
  - The top row shows the millivolt (mV) outputs from each installed analog sensor.
- Controller and Sentinel Outputs
  - The second and third rows display the PO_2 values calculated by the Controller and Sentinel systems.
- Sensor Configurations
  - With three analog cells installed, three mV values appear.
  - With two analog cells and one Halcyon GreenFlash™ Optode, the third display shows a correction factor that aligns the output.

5.2.3. Calibration Failure

- If readings are invalid or cell discrepancies exceed allowable limits, the display shows CALFAILED. The permissible range is from 38 mV to 80mV at 1 bar PO_2.
- In this case, calibration must be repeated after confirming sensor condition and placement.

5.2.4. Completing Calibration

- At the end of the cycle, the Handset and HUD prompt the diver to:
  - Remove the calibration cap.
  - Close the oxygen supply.

_ The system automatically drains the oxygen line, then displays CHECKAIR.

_ Leave the CCR head open to ambient air and confirm that PO_2 values return to baseline.

_ The two-point calibration process provides improved accuracy and long-term sensor precision.

5.2.5 System Verification

_ Icons in the top-left and top-right corners confirm active transmission from the Controller and Sentinel.

_ This allows the diver to verify that both systems are broadcasting correctly.

5.3 Mounting the CCR Head

_ Inspect the CCR head for visible damage, missing sensors, or compromised O-rings.

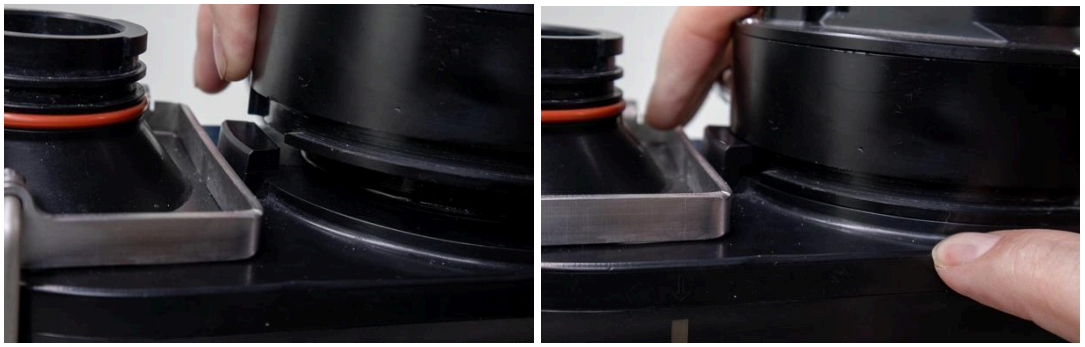
_ The O-rings of the CCR head should be well lubricated with oxygen-compatible grease.

_ Verify oxygen addition ports are unobstructed on both CCR Head and Scrubber Canister.

_ Place the CCR head on the canister, being sure to align the arrow with the index mark on the canister. The HP and LP hoses should be connected and facing forward. The quick-disconnect LP hose should not be connected.

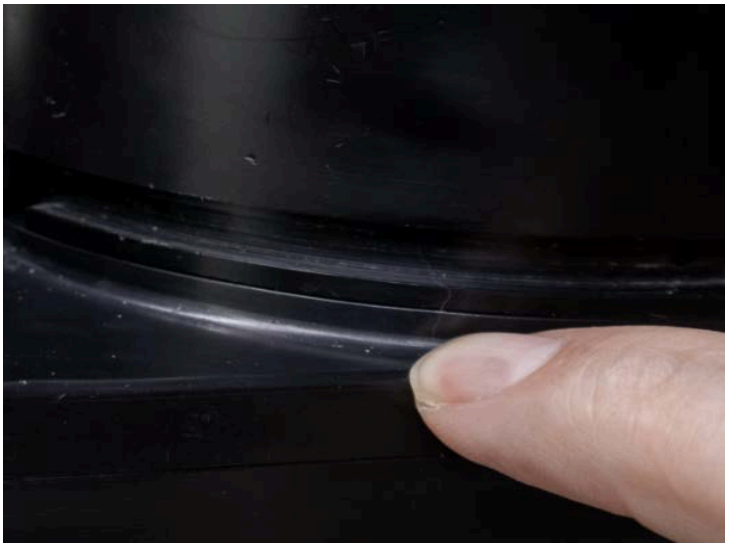
_ Ensure the position is correct and press evenly to seat the head. DO NOT press down on the head unless the position is oriented properly.

_ Verify clearance around the CCR Head and alignment with fixing tabs



_ Ensure the head is evenly seated and no O-rings are protruding. It is critical that the head is properly positioned and fully seated before turning it into place. Verify alignment as indicated and seat the head fully before turning.

_ Verify the head is seated completely and the barrel O-rings are not visible at any point around the circumference of the CCR Head.



_ Rotate the head, 90° clockwise until the lock symbol is positioned at the index mark. Attach the quick-disconnect, LP hose and verify the inhalation port is between the two hoses, allowing more room to attach the counterlung.



NOTICE

The O-rings of the CCR head should be well lubricated with oxygen-compatible grease to ensure a smooth 90° rotation of the eCCR head.

⚠ WARNING

Incorrect alignment combined with excessive force may cause mechanical damage to the eCCR head or the scrubber.

5.3.1 Connecting the Oxygen Feed Hoses

- Route hoses through the right-side opening of the outer bag.
- Verify connection of the HP oxygen hose to the CCR head input.
- Verify connection of the IP oxygen hose to the solenoid input.
- Verify the quick-disconnect coupling from the MAV.

⚠ WARNING

OXYGEN FIRE / EXPLOSION RISK

Oxygen handling poses serious fire and explosion hazards. Strict adherence to the following rules is mandatory:

- All components connected to the oxygen regulator must remain oxygen-cleaned and oxygen-compatible. This includes hoses, hose connections, fittings, HP hoses, and LP hoses.
- Connection or disconnection of oxygen hoses may only be performed by trained personnel qualified in oxygen-clean servicing.
- Never connect or disconnect hoses in a contaminated or non-oxygen-clean environment. Hydrocarbons, grease, dust, or particles may act as ignition sources.
- Never use an oxygen cylinder warmer than 30 °C/86 °F. High temperature increases ignition risk.
- Always pressurize the system slowly. Note: *Opening a valve slowly is not the same as pressurizing slowly.* Ensure gradual pressurization to avoid adiabatic heating.
- Fully depressurize hoses before disassembly. Opening or removing fittings under pressure may cause fire or explosion.
- Only approved lubricants and sealing materials may be applied to oxygen service components. Unapproved materials may ignite under oxygen exposure.

Failure to comply with these requirements creates a severe risk of fire, explosion, serious injury, or death.

The manufacturer accepts no responsibility or liability if these rules are not strictly followed.

5.4 Mounting the ADV/BOV

Before installation, ensure the ADV/BOV is in proper working condition. Careful inspection and correct orientation during mounting are essential for safe and reliable operation of the breathing loop. Follow the steps below to verify, align, and secure the ADV/BOV onto the CCR head.

_ Inspect the ADV/BOV for damage or worn O-rings.

_ Confirm the OC/CC bezel rotates freely and the ADV button functions.

_ Mount onto the CCR head with the inhalation side (green O-ring) facing forward. Rotate 90° clockwise until locked.

_ Connect and tighten the diluent feed hose to the ADV/BOV inlet.

5.5 Mounting the Counterlungs

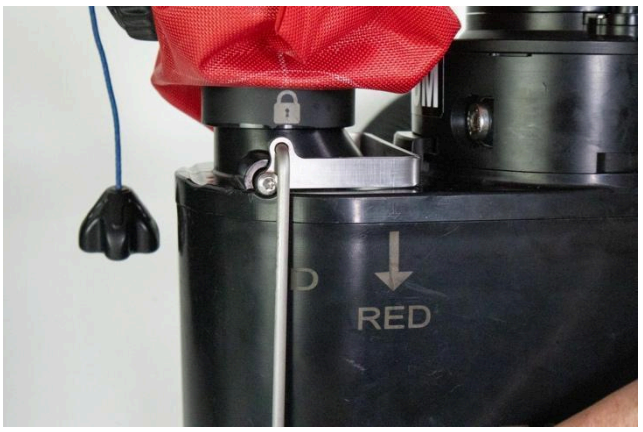
Proper installation of the counterlungs is essential for both breathing performance and overall system function. Before each dive, ensure that the counterlungs are correctly oriented, securely attached to the harness system, and free of twists or obstructions. This section outlines the step-by-step procedure for mounting the counterlungs, including verification of all connections and fittings to support safe and comfortable operation of the Symbios CM Rebreather.

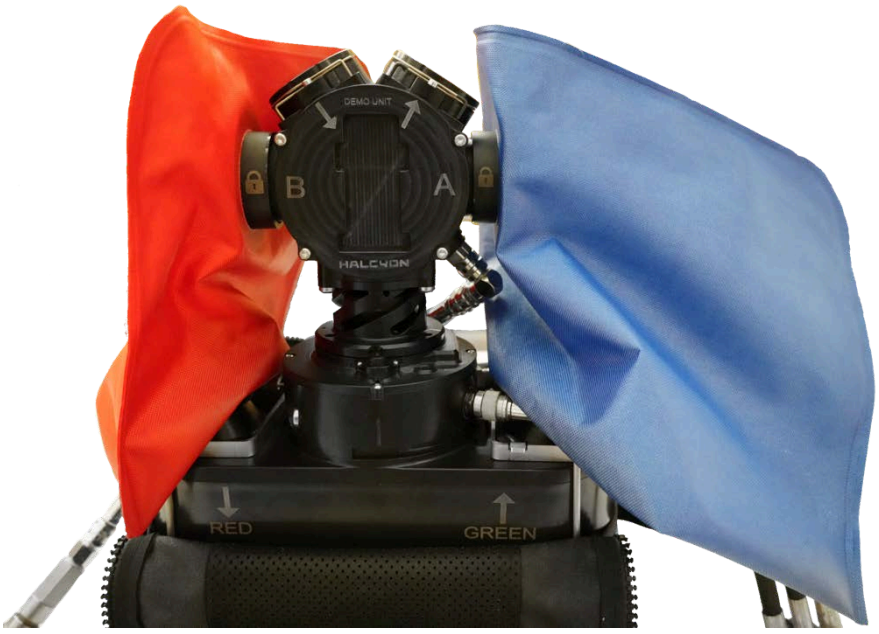
- Inspect the counterlungs for damage or contamination.
- Confirm O-rings on the ADV/BOV and canister fittings are in good condition.
- Match A markings on the inhale and BOV/ADV fittings.
- Carefully seat and rotate clockwise to lock.
- Note lock indication position on the counterlung.

- Repeat the procedure for the exhale counterlung noting alignment of the letter B.

- Follow with the lower attachment to the scrubber, aligning C on the inhale counterlung.
- Rotate the CCR Head if necessary to allow centering of the counterlung fitting.

- Complete the process, aligning D on the exhale counterlung.

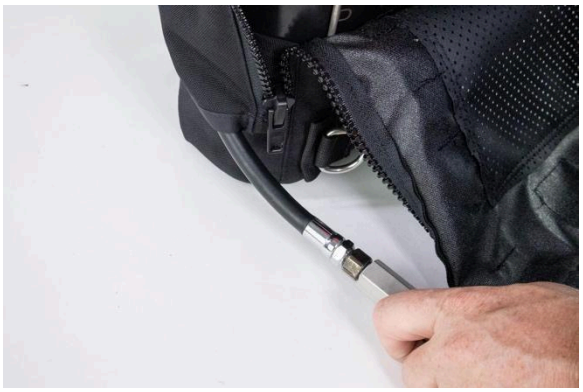




_ Raise the outer bag, align the bezel cut-out.

_ Route the OPV cord through the slot.


_ Route the Diluent hose through the bottom or side as preferred.

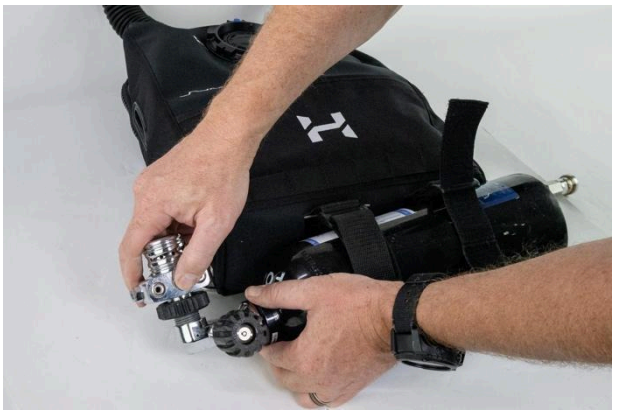



5.6 Installing the Onboard Oxygen Cylinder and Regulator

When mounting the oxygen cylinder, always take care to prevent contaminants from entering the system by keeping the dust cap on and ensuring hoses remain connected whenever possible. While mounting preferences may vary, the recommended orientation is with the first stage pointed toward the diver for optimal accessibility and hose routing.

_ Slide the oxygen cylinder through the retaining straps.

_ Inspect the regulator O-ring; install and hand-tighten.



_ Secure by tightening the straps.

5.7 Installing the Breathing Loop

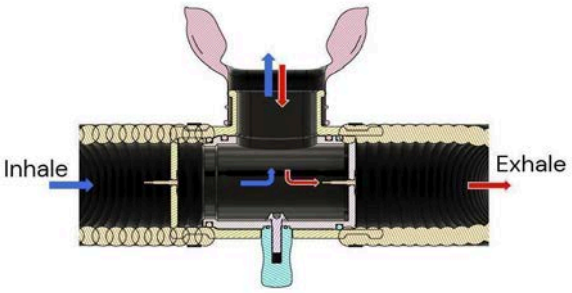
Correct installation of the rebreather (RB) loop is critical to diver safety and system performance. An improperly assembled loop can result in leaks, increased breathing resistance, or even water ingress into the breathing circuit—all of which may compromise the oxygen delivery or scrubber function. Before every dive, the loop should be carefully inspected for correct hose routing, secure connections, and proper orientation of the mouthpiece, one-way valves, and counterlungs. Always follow appropriate procedures to ensure a sealed and functional breathing loop.

⚠ WARNING

Carefully inspect hoses, fittings, and non-return valves. Failure to properly verify one-way flow can result in CO_2 intoxication and may be fatal.

- Inspect hoses, O-rings, and DSV for damage.

- Test non-return valves:
  - Block exhalation side → exhale → no flow should pass.
  - Block inhalation side → inhale → no flow should pass.



⚠ WARNING

Risk of CO_2 Retention and Loop Contamination Due to Damaged One-Way Valve

A malfunctioning or damaged one-way valve in the rebreather hose can cause reverse gas flow within the breathing loop. This may lead to CO_2 rebreathing, scrubber inefficiency, or water intrusion, all of which can result in hypercapnia, loss of consciousness, or drowning. Always inspect and test one-way valves before each dive. Replace any valve showing signs of damage, wear, or improper sealing.

⚠ WARNING

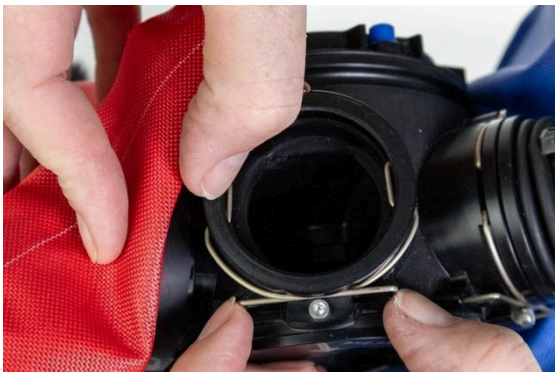
Risk of Hypercapnia from Leaking DSV

A leaking Dive Surface Valve (DSV) can allow water to enter the breathing loop or enable the escape of exhaled gas, leading to reduced scrubber efficiency and CO_2 buildup. This can result in hypercapnia, a life-threatening condition characterized by excessive carbon dioxide in the body. Always inspect the DSV for damage, ensure secure closure, and verify proper sealing before each dive. Never dive with a known or suspected DSV leak.

_ Insert hoses through the outer bag and connect to the BOV.

- _ Right (blue O-ring) = inhalation.
- _ Left (red O-ring) = exhalation.

_ The rebreather hose fittings are easily inserted into the BOV/ADV by squeezing the fitting retainers. Notice the action allows internal tabs to seat on the hose couplings.



_ Insert the hose into the opening, press and seat the hose. Gently move and pull lightly on the fitting to ensure it is seated properly.

_ Verify both inhale and exhale fittings are secure.

5.8 Checking the Diluent Gas Feed

_ Verify the diluent feed hose is connected to the BOV/ADV.

_ Ensure proper routing of the hose as it leaves the outer bag.

_ Confirm regulator intermediate pressure is 9.0–9.5 bar.

_ Ensure the cylinder contains the correct diluent gas mixture for the dive.

5.9 Loop Integrity Tests

_ Set the ADV/BOV to CC+ mode.

_ Perform a negative test: inhale to collapse counterlungs, close the DSV, hold for 3 minutes. Counterlungs must stay collapsed.

_ Perform a positive test: exhale to inflate counterlungs, close the DSV, hold for 3 minutes. Counterlungs must stay inflated.

_ Confirm stability via the handset loop pressure display if available. Mbar reading is in the depth field of the second screen.

⚠ WARNING

Surface Pressure Calibration Required Before Loop Integrity Tests

Failure to calibrate surface pressure at your current location may lead to incorrect positive or negative mBar readings, even when the unit is functioning correctly.

This typically occurs when:

_ The unit was previously calibrated at a different altitude or location, and

_ A new surface pressure reading has not been updated prior to the test.

_ Always perform a head calibration with changing locations and before conducting loop integrity tests. This ensures that positive and negative mBar values are accurate and meaningful relative to local atmospheric pressure.

⚠ WARNING

A rebreather must never be dived if it fails loop integrity tests. Any detected leak or failure in maintaining loop pressure compromises safety. If the unit does not pass both positive and negative pressure checks, do not attempt to dive. Resolve the issue, replace faulty components, or have the system serviced by an authorized technician before use.

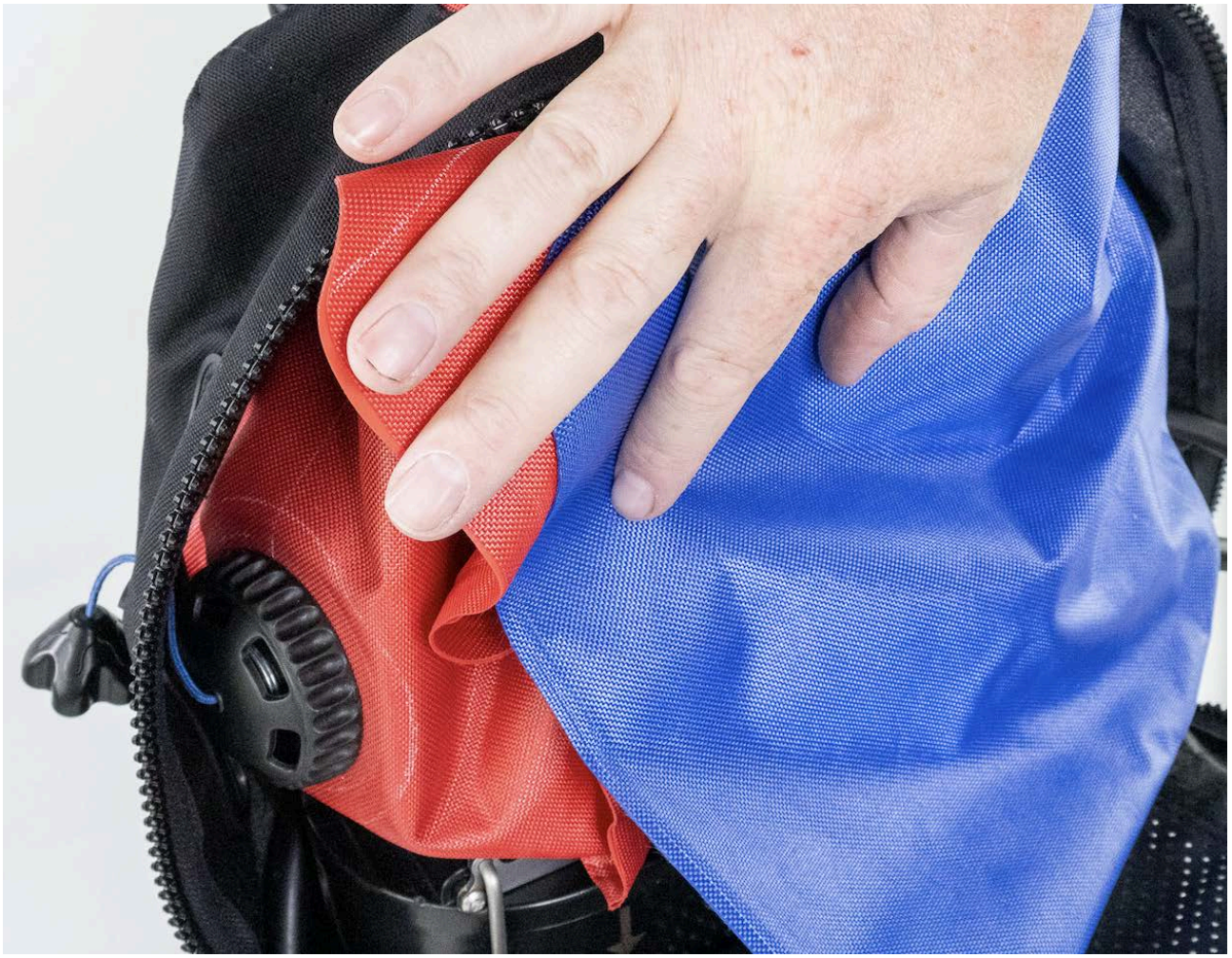
_ If necessary, the outer bag can be removed without detaching the loop, allowing more extensive review of potential vulnerabilities.

_ Use care while removing the loop to avoid any damage.



_ Following a successful test, finish closing the outer bag

_ Bring the inhale lung across and verify alignment of internal components.



_ Close the zipper and ensure all components are properly placed.

_ Verify access to the CCR button and check all hoses are properly routed.

6 Diving The Symbios CM Rebreather

6.1 Activation of the unit

The Symbios CM Rebreather can be activated in several ways, depending on its current operational state.

- Automatic Activation via Oxygen Supply: Connect an oxygen cylinder to the CCR head and open the valve. The presence of oxygen pressure will automatically activate the CCR electronics, preparing the head unit for operation and communication with connected devices.
- Automatic Activation via Loop Assembly: When the unit is assembled with the ADV/BOV combination mounted on the head, rotating the rotary bezel to the "CC" (Closed Circuit) position will automatically switch on the CCR electronics. The system will then be ready for use and able to connect to the Symbios Handset or HUD.
- Dive Mode Activation: The unit switches into dive mode as soon as it reaches a depth > 1m. This also starts the dive logging function.

NOTICE

The unit will enter standby mode if it remains switched on at the surface without user interaction for more than 1 hour. Any subsequent user action—such as pressing the CCR button, adjusting the bezel, or connecting gas supply—will return the system to its normal operating mode.

6.2 Switching the Unit Off

To safely power down the Symbios CM Rebreather electronics, the following steps must be completed in order:

- Rotate the OC/CC bezel to the OC (Open Circuit) position.
- Close the oxygen supply valve to stop gas flow to the CCR head.
- Purge the oxygen line using the Oxygen Manual Addition Valve (O_2 MAV) to ensure the line is fully depressurized.

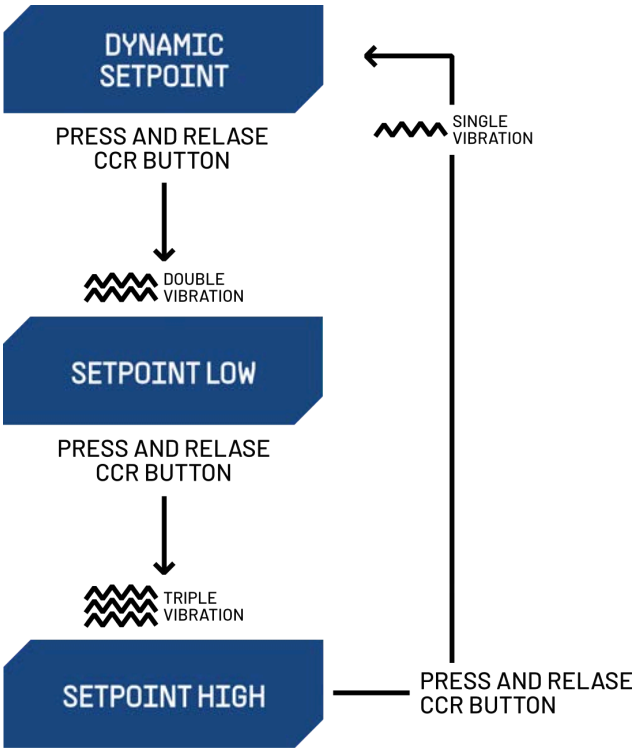
Once all three steps are completed, the CCR electronics will automatically enter sleep mode after 60 seconds. This delayed shutdown ensures all components are safely deactivated and prevents unintentional reactivation due to residual pressure or loop configuration.

NOTICE

Always verify that the system has fully powered down before storage or transport. Residual pressure or an incorrect loop position may delay or prevent shutdown and discharge the battery.

6.3 Setpoint Control

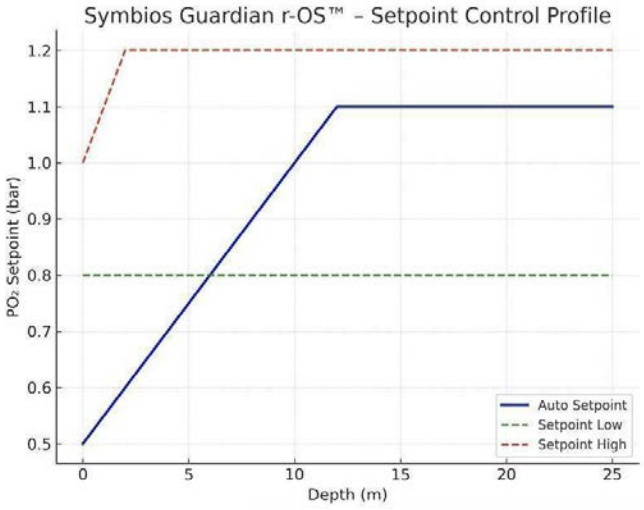
The Symbios CM Rebreather provides three selectable PO_2 setpoints. Setpoints cycle sequentially with each press of the CCR Button.



_ Auto (Dynamic) Setpoint – Maintains ~50% oxygen fraction during descent, adjusting until the chosen maximum PO_2 is reached (1.0–1.2 bar). During ascent, switches back to FO_2 maintenance. Confirmed by one vibration sequence.

_ Low Setpoint – Maintains a user-selected PO_2 between 0.4–1.0 bar. Confirmed by two vibration sequences.

_ High Setpoint – Maintains a user-selected PO_2 between 1.0–1.4 bar. Confirmed by three vibration sequences.



6.4 Functional Pre-Dive Check

Performing thorough pre-dive checks on the Symbios Rebreather is critical to both safety and performance. These checks ensure that life-support systems, sensors, and breathing loop components are functioning correctly before entering the water. Even seemingly small oversights can compromise safety or shorten dive duration. Always follow the pre-dive checklist in detail — either directly within the Symbios App or in the checklist provided in the Appendix — to confirm your unit is ready for use.

⚠ WARNING

Verify online documents and Halcyon App to ensure access to the most current checklist. Check the appendix for a complete version of all checklists.

6.5 Securing the Unit to the Diver

_ Use a separate harness and buoyancy compensator.

_ The unit must be worn on the chest, with counterlungs at lung height.

_ The buoyancy compensator must provide sufficient lift to offset a complete unit flood.

_ Ensure the rebreather rests at an appropriate height and that the mouthpiece sits comfortably in the mouth. Adjust the rebreather height and hose position until the mouthpiece fits comfortably with a relaxed jaw.

_ Incorrect mounting may affect breathing characteristics and compromise compliance with EN 14143:2013.

6.6 Water Ingress Protection

Effective water ingress protection at the mouthpiece/facepiece requires a combination of proactive and reactive measures. Proactive measures minimize the likelihood of water entry and reduce diver workload. Reactive measures are fallback actions once ingress has occurred, but these place a much higher burden on diver safety and depend heavily on timely team intervention.

The Symbios CM Rebreather supports the following proactive and reactive measures:

_ Ergonomic mouthpiece retention

_ Buoyancy-neutral breathing loop configuration

_ Easy hose adjustment and routing for optimal fit

_ Promotion of conservative PO_2 levels

_ Team diving protocols and training safeguards

_ Proactive PO_2 alerting systems

_ Optional use of a mouthpiece retention strap where additional retention is required

6.6.1 Mouthpiece Fitting

A secure and comfortable fit of the mouthpiece is essential for preventing water ingress:

- Ensure the mouthpiece sits securely in the mouth even with a relaxed jaw.
- Adjust hose positioning before every dive; rotate the coupling at the hose base to establish the correct angle.
- Confirm the rebreather unit is positioned high enough so that hoses are not pulling downward on the mouthpiece.
- If retention is insufficient, use bite tabs or a molded mouthpiece.
- Where fit remains doubtful, consider using a mouthpiece retention strap.

⚠ WARNING

Mouthpiece Fit

Before and during each dive, confirm that the mouthpiece fits comfortably and ergonomically, conforming securely between the lips and teeth. Verify hose positioning and ensure a neutral or slightly positive loop buoyancy to reduce gravitational pull on the mouthpiece.

⚠ WARNING

Retention Devices

Use bite blocks or molded tabs if retention under relaxed jaw conditions is inadequate. Additional retention devices may be used but must not impede rapid removal of the mouthpiece during bailout, flooded loop management, or caustic cocktail events.

⚠ WARNING

PO_2 Management

Maintain conservative PO_2 levels and respond immediately to both low and high PO_2 indications. Switch to open-circuit supplies if either unsafe conditions arise or if the safety of the breathing mixture is uncertain.

⚠ WARNING

Team Support

Always dive with trained team members who can immediately assist with mouthpiece repositioning, airway protection, and rapid egress in case of diver incapacitation.

⚠ WARNING

Alert Systems

Maintain and verify the functionality of all Symbios warning systems, including arm- and chest-mounted haptic alerts. These redundant systems provide early warnings of low or high PO_2 conditions, well before incapacitation occurs.

6.7 Oxygen Addition Logic and Sensor Rules

Oxygen addition within the Symbios CM Rebreather is governed by the average of all *active* PO_2 sensors. If the average PO_2 falls below the current setpoint (SP), the system will initiate O_2 injection for a time interval determined by the deviation between the average PO_2 and the setpoint.

Rather than relying on a basic majority-vote approach, the Symbios Guardian r-OS™ applies a layered logic framework to enhance safety and robustness, as follows:

Sensor Activation Criteria

- Exclusion Threshold:
Any sensor reporting a $PO_2 < 0.02$ bar is

automatically excluded from further calculations. Such readings are considered invalid, and the sensor is deemed *inactive*.

– No Active Sensor / No Calibration Data:
If no sensors are active *or* valid calibration data is unavailable, no oxygen injection will occur. This prevents injection based on unverified or potentially hazardous sensor input.

Oxygen Injection Conditions

– Low PO_2 Response:
If two or more active sensors report a PO_2 < 0.30 bar, the system will inject oxygen for a fixed 600 ms interval.

⚠ WARNING

This response is a protective measure to rapidly respond to dangerously low PO_2 levels even in the presence of sensor divergence. Failure to monitor and correct problems can lead to serious injury or death.

– High PO_2 Cutoff:
No O_2 injection is permitted if any active sensor reports a PO_2 above the higher of:

1.40 bar, or
(Current SP + 0.10 bar)

⚠ WARNING

This upper limit prevents over-oxygenation in the event of sensor drift or ambient pressure fluctuations. Failure to monitor and correct problems can lead to serious injury or death.

NOTICE

If the descent is greater than10m/min, a descent protection system pauses injection to avoid PO_2 spikes.

6.7.1 Low PO_2 Setpoint

– Low Setpoint – Maintains a user-selected PO_2 between 0.6–1.0 bar. Confirmed by two vibration sequences.

6.7.2 High PO_2 Setpoint

– High Setpoint – Maintains a user-selected PO_2 between 1.1–1.4 bar. Confirmed by three vibration sequences.

6.7.3 Dynamic (Auto) PO_2 Setpoint

Dynamic Setpoint – Maintains ~50% oxygen fraction during descent, adjusting until the chosen maximum PO_2 is reached (.8 – 1.2 bar). During ascent, switches back to FO_2 maintenance. Confirmed by one vibration sequence.

6.8 Good Diving Practices

6.8.1 Minimum Loop Volume

Always maintain sufficient loop volume to avoid excessive breathing resistance or risk of "sucking the loop dry." The loop should be neither over-inflated (which increases buoyancy control difficulty) nor under-filled (which increases the chance of hypoventilation and CO_2 retention).

6.8.2 Deco with O_2

During decompression, ensure correct use of oxygen-rich setpoints or open-circuit O_2 as planned. Carefully monitor PO_2 levels to prevent both hypoxia and oxygen toxicity and

adhere strictly to decompression schedules provided by the dive computer or plan.

6.8.3 Switching to CC+

The CC+ mode increases cracking pressure and therefore breathing resistance. Despite this, it offers two important advantages:

- Easier achievement of minimum loop volume – CC+ makes it simpler to reach and maintain the correct loop volume, reducing complications from buoyancy fluctuations and allowing finer control of oxygen levels.
- Reduced risk of hypoxic gas addition – By limiting accidental introduction of hypoxic gas, CC+ helps maintain safe oxygen levels in a manner that supports efficient decompression.

6.8.4 Team Diving

Diving with a competent CCR buddy provides an additional safety margin. Agree on communication signals, bailout procedures, and depth/time limits before the dive. Buddies should remain in close proximity, capable of offering immediate assistance in case of hypoxia, hyperoxia, or loop flooding.

6.8.5 Moderate PO_2 Levels

Maintain moderate PO_2 setpoints in line with training and dive plans. Extremely low setpoints increase the risk of hypoxia and inert-gas uptake, while high setpoints raise oxygen toxicity risk. A balanced strategy, including use of Halcyon's Dynamic Setpoint supports both safety and decompression efficiency.

6.8.6 Breathing Technique and Trim

The optimal diver position for minimal breathing effort is a trim angle of 0–20°, with the head in line with or slightly above the legs. Breathing should always be deep and continuous. Correct breathing and trim reduce the risk of CO_2 retention and ensure efficient loop performance.

⚠ WARNING

Training requirement

- The Symbios CM Rebreather must never be used without specific training provided by an authorized training association.
- This manual is a reference guide only. It supplements, but does not replace, the training materials of a certifying agency or the direct instruction of a qualified, factory-approved instructor.
- It does not cover all critical aspects of rebreather diving.

6.9 General Diving Considerations

Safe operation of the Symbios CM Rebreather requires the diver to maintain constant awareness of:

- PO_2 readings
- Selected setpoint
- Battery levels
- Depth and time
- Scrubber timer status
- Cylinder pressures

This information is continuously available via the Symbios Handset and HUD. Any alarm

displayed must be investigated immediately, and appropriate corrective action taken.

6.9.1 Changing Body Positions

– Breathing effort may become harder or easier through various body positions. Divers should be aware of these changes and avoid remaining in any position where breathing is uncomfortable.

6.9.2 Loop Volume Management

Optimum loop volume should be maintained throughout the dive.

– Optimum loop volume is defined as the volume required for the diver to complete a full inhalation without triggering the ADV.
– Overfilling the loop increases buoyancy instability; underfilling increases work of breathing.

6.10 Emergency Procedures

This section outlines the critical actions to be taken in the event of system malfunction or life-support failure while using the Symbios CE Rebreather. Familiarity and regular practice of these procedures are essential to ensure a calm, effective response in any emergency situation.

6.10.1 Bailout Readiness

A closed-circuit rebreather can fail without warning. The diver must always carry a bailout system capable of providing sufficient breathing gas for a safe ascent under foreseeable emergency conditions. This may be part of the rebreather supply, provided the system can be isolated and that ample reserves are available.

⚠ WARNING

Primary Bailout Procedure: In the event of malfunction, the diver must switch immediately to an independent open-circuit bailout system. An independent second-stage regulator mounted on a necklace is strongly recommended to ensure rapid and reliable access.

Secondary Bailout Option: If immediate access to the independent system is not possible, the diver may use the Bailout Valve (BOV) in open-circuit (BO) mode. This option is particularly relevant when elevated CO_2 levels (hypercapnia) impair breathing and urgent gas exchange is required.

6.10.2 Hypoxia (Low PO_2)

Symptoms: confusion, dizziness, tunnel vision, loss of consciousness (may occur without warning).

Actions:

– Immediately check handset and HUD PO_2 values.
– Add oxygen manually via the MAV.
– If PO_2 does not rise promptly, switch to OC mode via the BOV and bail out to the open-circuit system.
– Abort the dive.

6.10.3 Hyperoxia (High PO_2)

Symptoms: visual disturbances, nausea, twitching, convulsions (may occur suddenly).

Actions:

- Immediately check handset and HUD PO_2 values.
- Switch to OC mode via the BOV.
- Flush the loop with diluent to reduce PO_2.
- If PO_2 remains elevated or symptoms persist, remain in OC mode and abort the dive.

6.10.3 Hypercapnia (CO_2 Breakthrough)

Symptoms: headache, shortness of breath, anxiety, rapid breathing, confusion, panic.

Actions:

- Switch immediately to open circuit BO mode using the BOV.
- Bail out to an independent open-circuit system.
- Abort the dive and ascend safely.

⚠ CAUTION

Scrubber duration
Always respect the maximum tested scrubber duration. Exceeding this limit greatly increases risk of CO_2 breakthrough.

6.10.4 Flooded Loop and Caustic Cocktail Hazards

CO_2 absorbent is an alkaline compound that reacts with water to form a highly caustic slurry. If enough water enters the scrubber bed and mixes with the absorbent, a "caustic cocktail" may result.

Identification

- Extremely unpleasant taste described as *soapy, bitter, or burning*.
- Immediate gagging or coughing reflex.
- Possible burning sensation in mouth, lips, or throat.

Risks

- Chemical burns to oral and respiratory tissues.
- Airway swelling or irritation, potentially compromising breathing.
- Inhalation of alkaline aerosol may cause severe respiratory injury.

⚠ WARNING

Do Not Continue Breathing
If you detect a caustic taste in the loop:

1. Bail out immediately to an open-circuit breathing supply.
2. Do not swallow any liquid present.
3. Rinse mouth with clean water and expel thoroughly.
4. Abort the dive and ascend safely following proper protocols.
5. Upon surfacing, seek medical evaluation for possible caustic exposure.

6.10.5 Electronics or Display Failure

Symptoms: loss of handset/HUD display, frozen values, or communication error.

Actions:

_ Cross-check between handset, HUD, and vibration alarms.
_ If redundancy is lost and PO_2 cannot be reliably monitored, bail out to open circuit.
_ Abort the dive.

6.10.6 Total System Failure

Actions:

_ Immediately switch to OC mode with the BOV.
_ Bail out to the independent open-circuit system.
_ Abort the dive and make a controlled ascent following bailout gas planning and decompression obligations.

7 Post-Dive Care

The information in this section supports correct procedures for maintenance of the rebreather. Proper post-dive care ensures the Symbios CM Rebreather remains safe, reliable, and compliant with EN 14143:2013. The following steps must be performed after every dive.

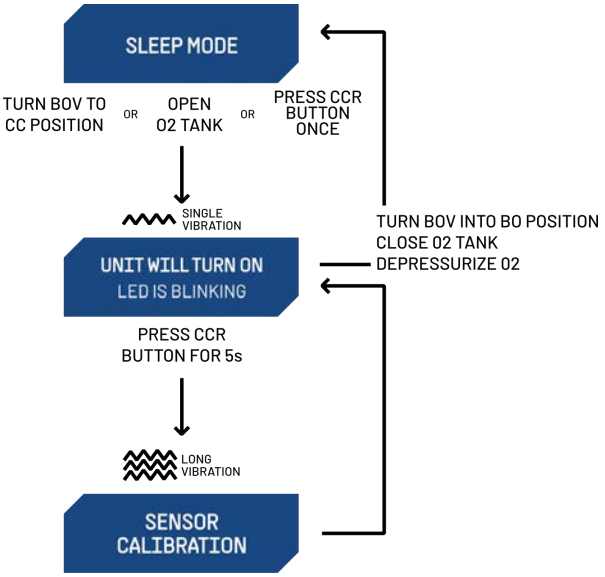
⚠ WARNING

Oxygen fire risk

_ Close and purge oxygen systems only out of the water.
_ Never disconnect oxygen hoses under pressure.
_ HP and LP oxygen feed hoses should remain connected to the head to avoid contamination.

7.1 Shutdown

_ Remove the Symbios CM Rebreather from the water.
_ Close the onboard oxygen cylinder valve and purge the oxygen lines.
_ Switch the unit to BO/OC mode.



7.2 External Rinse

_ Set the selection to CC+, disconnect diluent, and immerse the entire rebreather in fresh water.
_ Rinse the outer bag and external surfaces with fresh water as necessary.

_ Open the bag zipper and lower the bag.
_ Carefully rinse the interior components with fresh water as necessary.

If the unit will be used again on the same day:

_ Reassemble the outer bag, close the zipper, and repeat the pre-dive functional check.
_ If diving is complete, continue with disinfection and disassembly.

7.3 Disinfection

Prepare a solution of Virkon™ S or equivalent, multi-purpose, broad-spectrum disinfectant. Mix a solution and immerse parts according to the manufacturer's specifications.

- Remove the breathing loop, disinfect thoroughly, rinse with fresh water, and place in a cool, dry place to dry.
- Remove the counterlungs, disinfect and rinse them thoroughly, and allow to dry completely.
- Remove the ADV/BOV assembly, disinfect and rinse thoroughly, and allow to dry.

7.4 Regulator and CCR Head

- Remove the oxygen regulator and install a protective cap.
- Disconnect the oxygen MAV quick-disconnect.
- Rotate the CCR head counterclockwise to disengage it from the canister.
- Wipe the CCR head dry with a clean, lint-free cloth.
- Let the head air dry and then install the calibration cap for protection.
- Remove the onboard oxygen cylinder.

7.5 Scrubber Canister and Bag

- Remove the CO_2 absorbent canister from the outer bag. Place the bag in a cool, dry area to dry.
- Open the securing latches and remove the canister from the canister case.
- Rinse the canister case thoroughly with fresh water and dry in a cool, ventilated area.

7.6 Absorbent Removal

- Remove the wingnuts securing the mesh, then remove the foam filter.
- Discard the used CO_2 absorbent in accordance with local laws and environmental regulations.
- Wipe the absorbent canister dry, ensuring all absorbent residue is removed.

7.7 Drying and Storage

- Place all rinsed and disinfected components (breathing loop, counterlungs, ADV/BOV, canister, bag) in a cool, dry, and shaded location to air-dry fully.
- Store the CCR in a dry environment away from hydrocarbons, direct sunlight, and excessive heat.
- For storage over one week: remove absorbent.
- For storage over one month be sure to leave systems fully charged, depressurized, and in a dry, well-ventilated area.

8 Storing The Symbios CM Rebreather

Proper storage of the Symbios CM Rebreather is essential to preserve safety, prevent contamination, and maintain long-term reliability.

8.1 Storage Environment

_ Store the unit in a dry, well-ventilated area, protected from direct sunlight and UV radiation.
_ Avoid areas with hydrocarbon exposure, excessive humidity, or extreme temperatures.

8.2 Preparation Before Storage

_ Thoroughly clean and disinfect all breathing loop components in accordance with Chapter 7 – Post-Dive Care.
_ Ensure the entire unit is completely dry before storage.
_ The scrubber canister must be emptied, cleaned, and dried.
_ Place the empty canister back into the canister housing to maintain correct assembly and protect internal seals.

8.3 Storage Configuration

_ Store the Symbios CM Rebreather fully assembled to prevent dust, organisms, or foreign material from entering the breathing loop.
_ Install the DSV in a closed position to seal the loop.
_ Ensure cylinder valves are closed, and the hoses are depressurized.

8.4 Battery Maintenance

_ Regularly charge the CCR head battery while the unit is in storage.

8.5 Service Intervals and Periodic Inspections

The Symbios CM Rebreather must be maintained and serviced according to the following schedule:

Part	Maintenance Required	Interval
O-rings	Inspect all external O-rings accessible without disassembly	Every 6 months
	Replace all O-rings	Annually
Breathing loop	Replace DSV O-rings and DSV non-return valves	Annually
Galvanic O_2 sensors	Replace	1 year from manufacturing date
Oxygen regulator	Oxygen cleaning	Annually
	Overhaul	Annually
	Overpressure valve adjustment	Annually
	Intermediate pressure adjustment	Annually
ADV/BOV	Diaphragm inspection	Annually
	Cracking effort adjustment	Annually
	Overhaul	Every 2 years
Foam filter	Replace	On condition, no later than 50 dives
Diluent regulator	Intermediate pressure adjustment	Annually

	Overhaul	As per manufacturer's instructions
Oxygen & diluent hoses	Inspect	Annually
	Replace	Every 2 years
Symbios CM Rebreather	Full manufacturer inspection and servicing	Every 3 years

8.6 Authorized vs. User Maintenance

The user may replace the following parts:

- Oxygen sensors
- O-rings in the breathing loop
- Breathing hoses
- ADV/BOV purge-button diaphragm
- DSV one-way valves
- Absorbent canister wingnuts
- Oxygen solenoid
- Sensor PCB board
- Oxygen regulator hoses
- Counterlung assemblies

⚠ CAUTION

Restricted servicing

Periodic maintenance, inspections, and repairs of electronics, solenoid valves, 1st stage regulators, BOV, ADV, and any other components not specified above may only be performed by Halcyon Manufacturing or an authorized service center.

8.7 Usage Adjustments

- The maintenance intervals in this manual are based on normal use.
- If the Symbios CM Rebreather is used for intensive diving or training purposes, maintenance must be performed more frequently.
- Any defective or unreliable parts must be replaced immediately, regardless of the service interval, before further diving.

9 Notices

9.1 Identification

The Symbios CM Rebreather Head is permanently laser-marked with the following information:

- Unique serial number for product identification
- Manufacturer details
- Reference to applicable standards and normative documents
- Mandatory information required under CE and EN 14143 regulation

9.2 Trademark

Halcyon® and the H logo® are registered trademarks of Halcyon Manufacturing, Inc. The Halcyon Cinch is protected by U.S. Patents Nos. 8,398,337 and 10,407,142 and a corresponding European Patent. Halcyon common law trademarks include, without limitation, Symbios™, Multifunction Compensator™, Cinch™, H-Lok™,

X-Connector™, Eclipse™, Explorer™, and Evolve™ wings, BC Storage Pak™, Active Control Ballast™, Diver's Life Raft™, Surf Shuttle™, No-Lock Connector™, Helios™, Proteus™, and Apollo™ lighting systems, Scout Light™, Pathfinder™ reels, Defender™ spools, and the RB80™ rebreather.

9.3 Copyright

9.4 Disclaimer

Halcyon Manufacturing, Inc. reserves the right to make changes or improvements to its products, manuals, and specifications at any time without prior notice.
While every effort has been made to ensure accuracy, Halcyon Dive Systems assumes no liability for errors or omissions in this document.
Users are responsible for familiarizing themselves with the latest version of this manual and for following all applicable safety and maintenance instructions.

9.4.1 Translation Note

This manual may be available in multiple languages to comply with regional requirements. In the event of discrepancies between translations, the English version shall prevail.

10 Warranty

Halcyon Manufacturing, Inc. ("Halcyon") warrants that the Symbios CCR and its components are free from defects in material and workmanship under normal use and service, for a period of two (2) years from the original date of purchase, unless otherwise specified. Consumables, wear parts, and components subject to routine replacement (e.g., O-rings, sensors, hoses, batteries, mouthpieces) are excluded from this coverage.

This warranty is valid only when:

- The product has been properly used, maintained, and serviced in accordance with the Symbios CCR User Manual.
- Repairs or modifications have not been attempted by unauthorized persons or non-approved service centers.
- The unit has not been misused, neglected, exposed to accident, fire, or damage outside normal diving operations.

Halcyon's obligation under this warranty is limited to repair or replacement, at its discretion, of any defective part returned during the warranty period. Shipping, insurance, or other incidental costs are the responsibility of the customer.

This warranty does not extend to incidental or consequential damages, including (but not limited to) loss of use, inconvenience, loss of time, or commercial losses.

10.1 Liability Limits, Warranty Disclaimer and Assumption of Risk

The Symbios CCR is a life-support system designed for trained and qualified divers only. By purchasing and using this equipment, the user accepts the following limitations of liability:

10.1.1 Assumption of Risk

Purchaser acknowledges that scuba diving and the use of closed-circuit rebreather systems involve inherent risks, including but not limited to drowning, hypoxia, hyperoxia, hypercapnia, decompression illness, barotrauma, equipment malfunction, and other hazards associated with deep or technical diving. Purchaser further acknowledges that the safe use of any Halcyon rebreather requires formal training, continuing education, adherence to all manufacturer instructions, and personal diligence in equipment inspection and maintenance. Purchaser voluntarily assumes all such risks.

10.1.2 Additional User Responsibility

Safe operation requires strict adherence to the Symbios CCR User Manual, EN 14143 standards, and recognized diving practices.

The user is solely responsible for training, dive planning, monitoring of oxygen exposure, gas mixes, and proper pre-dive checks.

10.1.3 Excluded Risks

Halcyon and its distributors shall not be held liable for injury, death, or damage arising from:

Diving beyond certified training, depth, or exposure limits.

Improper maintenance, servicing, or use of non-approved parts.

Neglect, misuse, tampering, or unauthorized modifications.

Environmental hazards such as entanglement, entrapment, or uncontrolled ascent/descent.

Oxygen fires caused by improper handling, contamination, or exposure of oxygen systems to hydrocarbons, lubricants, or other flammable materials.

Use of incompatible gases, gas mixes, or improperly analyzed cylinders.

10.1.4 Limitation of Claims

To the fullest extent permitted by law, Halcyon's liability is strictly limited to the repair or replacement of defective components. In no event shall Halcyon be responsible for indirect, incidental, or consequential damages, including property loss, personal injury, or death.

⚠ WARNING

Rebreathers carry inherent risks, including but not limited to hypoxia, hyperoxia, hypercapnia, decompression illness, and oxygen fires. These risks cannot be eliminated even when the equipment is properly used and maintained. By using the Symbios CCR, the diver accepts full responsibility for these risks.

10.1.5 Limited Warranty; Disclaimer Of Other Warranties

Halcyon Manufacturing, Inc. ("Halcyon") provides only the express limited warranty accompanying the product at the time of sale. Except as expressly stated in that limited warranty and to the maximum extent permitted by applicable law, Halcyon disclaims all other warranties, whether express or implied, including but not limited to any implied warranties of merchantability or fitness for a particular purpose. No

representative, distributor, or dealer is authorized to modify or extend any warranty on behalf of Halcyon.

10.1.6 Limitation of Liability

To the fullest extent allowed by applicable law:

(a) Halcyon shall not be liable for any indirect, incidental, consequential, special, exemplary, or punitive damages, including but not limited to loss of use, loss of revenue, loss of goodwill, or injury to property or persons arising out of or relating to the purchase, ownership, or use of the product;

(b) Halcyon's total cumulative liability, whether based on contract, warranty, tort (including negligence), strict liability, or otherwise, shall not exceed the amount actually paid by the purchaser for the specific product giving rise to the claim; and

(c) Nothing in this Agreement shall exclude or limit liability for death or personal injury caused by Halcyon's gross negligence or willful misconduct, where such exclusion or limitation would be unlawful.

10.1.7 International Sales and Local Law

Purchasers outside the United States understand that local consumer laws may confer rights in addition to those described here. Nothing in this Agreement is intended to exclude or restrict any non-waivable statutory rights available under such local law. To the extent permitted, the terms of this Agreement shall prevail.

10.1.8 Governing Law and Venue

This Agreement shall be governed by and construed in accordance with the laws of the State of Florida, U.S.A., without regard to conflict-of-laws principles. Any dispute arising out of or relating to this Agreement, any sale, or any product shall be brought exclusively in the state or federal courts located in Alachua County, Florida, U.S.A., and Purchaser consents to the jurisdiction of those courts.

10.1.9 Entire Agreement

This Liability Limits and Warranty Disclaimer section forms part of the overall User Manual between Halcyon and Purchaser. If any portion of this section is found invalid or unenforceable under applicable law, the remaining provisions shall remain in full force and effect.

11 Information

Halcyon Dive Systems
24587 NW 178th Place
High Springs, FL 32643
USA

info@halcyon.net
Tel: +1.800.HALCYON (425.2966)

European point of contact:
Halcyon Europe Sp z o.o. Wodnika 50, Pav 6

80-299 Gdansk, Poland

Appendix A: Declarations

Symbios Chest Mount Rebreather

CLOSED CIRCUIT REBREATHER 02S-003 CM "SYMBIOS" complies with the provisions of Module B and D of the Regulation (EU) 2016/425 Personal Protective Equipment with the with the national standard transposing harmonized standard:

EN 14143:2013 Respiratory equipment - Self-contained re-breathing diving apparatus

Polski Rejestr Statków S.A., Notified Body 1463, performed EU type-examination(Module B) of the Regulation (EU) 2016/425 Personal Protective Equipment and issued EU type-examination certificate CW/PPER/9/08/2025.

The production is subject to the procedure set out in Module D of EU Regulation 2016/425 under the supervision of Polski Rejestr Statków S.A., the notified body NO.1463. Certificate number: CW/PPER/10/08/2025

Symbios Handset

- EN250:2014: The combination of a Halcyon SYMBIOS HANDSET and the Halcyon SYMBIOS Tank Pod is a personal protective equipment under the Regulation (EU) 2016/425. Polski Rejestr Statków S.A, al. Gen. Józefa Hallera 12680-416 Gdansk, Poland, Notified Body No. 1463 performed EU type-examination (Module B) of the Regulation (EU) 2016/425 Personal Protective Equipment and issued EU type-examination certificate Nr CW/PPER/73/08/2025. The EC Type examination of the SYMBIOS HANDSET together with the Halcyon SYMBIOS Tank Pod was conducted by Polski Rejestr Statków S.A, al. Gen. Józefa Hallera 12680-416 Gdansk, Poland, Notified Body No. 1463 . In this case, the SYMBIOS HANDSET complies with EN250:2014 – respiratory equipment - open circuit self-contained compressed air diving apparatus – requirements, testing and marking – clause 6.11.1 Pressure Indicator for use with equipment that is compliant with EN12021. The air supply for equipment compliant with EN250:2014 shall meet the requirements for breathable air in accordance with EN 12021. The depth of equipment certification is 50 m/164 ft.

- The HALCYON SYMBIOS HANDSET or Symbios HUD in combination with the Halcyon SYMBIOS Tank Pod are subject to the conformity assessment procedure conformity to type based on the quality assurance of the production process plus supervised product checks at random intervals (Module D) under surveillance of the Polski Rejestr Statków S.A, al. Gen. Józefa Hallera 12680-416 Gdansk, Poland, Notified Body No. 1463

- EN13319 (European standard for depth gauges) Regulation (EU) 2014/53, Radio Equipment Directive

- EN 300 330:2017 V2.1.1 (Radio spectrum), Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU. EN 55032:2015 + A1:2020 + A11:2020 (EMC), Electromagnetic compatibility of multimedia equipment

- Emission requirements

Symbios HUD

The SYMBIOS HUD complies with:

_ EN250:2014: The combination of a Halcyon SYMBIOS HUD and the Halcyon Symbios Tank Pod is a personal protective equipment under the Regulation (EU) 2016/425. Polski Rejestr Statków S.A, al. Gen. Józefa Hallera 12680-416 Gdansk, Poland, Notified Body No. 1463 performed EU type-examination (Module B) of the Regulation (EU) 2016/425 Personal Protective Equipment and issued EU type-examination certificate Nr CW/PPER/73/08/2025. The EC Type examination of the SYMBIOS HUD together with the Halcyon Symbios Tank Pod was conducted by Polski Rejestr Statków S.A, al. Gen. Józefa Hallera 12680-416 Gdansk, Poland, Notified Body No. 1463. In this case, the SYMBIOS HUD is in conformity with EN250:2014 – respiratory equipment - opencircuit self-contained compressed air diving apparatus – requirements, testing and marking – clause 6.11.1 Pressure Indicator for use with equipment that is compliant with EN12021.The air supply for equipment compliant with EN250:2014 shall meet the requirements for breathable air in accordance with EN 12021. The depth of equipment certification is 50 m.
The Halcyon Symbios Handset or Symbios HUD in combination with the Halcyon Symbios Tank Pod are subject to the conformity assessment procedure conformity to type based on the quality assurance of the production process plus supervised product checks at random intervals (Module D) under surveillance of the Polski Rejestr Statków S.A, al. Gen. Józefa Hallera 12680-416 Gdansk, Poland, Notified Body No. 1463

_ EN13319 (European standard for depth gauges)

_ Regulation (EU) 2014/53, Radio Equipment Directive

_ EN 300 330:2017 V2.1.1 (Radio spectrum), Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.

_ EN 55032:2015 + A1:2020 + A11:2020 (EMC), Electromagnetic compatibility of multimedia equipment

_ Emission requirements.

Symbios Tank Pod

The SYMBIOS TANK POD is in conformity with:

_ EN 250:2014: The combination of a Halcyon Handset or HUD and the Halcyon Symbios Tank Pod is considered personal protective equipment under Regulation (EU) 2016/425. Polski Rejestr Statków S.A, al. Gen. Józefa Hallera 12680-416 Gdansk, Poland, Notified Body No. 1463 performed EU type-examination (Module B) of the Regulation (EU) 2016/425 Personal Protective Equipment and issued EU type-examination certificate Nr CW/PPER/73/08/2025. The EC Type examination of the SYMBIOS TANK POD, was conducted by Polski Rejestr Statków S.A, al. Gen. Józefa Hallera 12680-416 Gdansk, Poland, Notified Body No. 1463. In this case, the SYMBIOS TANK POD is in conformity with EN250:2014 – respiratory equipment - open-circuit self-contained compressed air diving apparatus – requirements, testing and marking – clause 6.11.1 Pressure Indicator for use with equipment that is compliant with EN12021.The air supply for equipment compliant with EN250:2014 shall meet the requirements for breathable air in accordance with EN 12021. The depth of the equipment

certification is 50 m.
The Halcyon Symbios Handset or Symbios HUD, in combination with the Halcyon Symbios Tank Pod, are subject to the conformity assessment procedure, conformity to type based on the quality assurance of the production process, plus supervised product checks at random intervals (Module D) under surveillance of the Polski Rejestr Statków S.A, al. Gen. Józefa Hallera 12680-416 Gdansk, Poland, Notified Body No. 1463

_ Regulation (EU) 2014/53, Radio Equipment Directive

_ EN 300 330:2017 V2.1.1 (Radio spectrum), Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.

_ EN 55032:2015 + A1:2020 + A11:2020 (EMC), Electromagnetic compatibility of multimedia equipment

_ Emission requirements.

The full text of the EU declaration of conformity is available at https://halcyon.net/support under *Instructions/Manuals > EU Declaration of Conformity Documents.*

Appendix B: Troubleshooting

Troubleshooting procedures are intended for trained users. If a fault cannot be immediately identified and corrected underwater, abort the dive and surface safely using appropriate bailout procedures.

General Principles

- Always verify oxygen supply and diluent supply first.
- Check HUD, handset, and vibration alerts for diagnostic information.
- If uncertain, bail out to open circuit and terminate the dive.

Common Issues and Corrective Actions

Symptom	**Possible Cause**	**Corrective Action**
HUD/Handset not powering on	Battery depleted	Recharge battery before diving
Frequent 'Low O_2' alarms	O_2 valve closed, empty tank, blocked port; faulty HP sensor	Check valve and pressure; Check sensors
High O_2 alarm	Solenoid leak, leaking MAV, rapid descent, wrong gas	OC bailout, flush loop, check O_2 levels, correct or abort
Excessive breathing resistance	Loop hoses kinked, counterlungs improperly positioned, or flooded canister	Check hose routing and counterlung; if flooded, bail out and abort dive
No response from CCR button	Travel Mode or button deactivated	Verify Travel Mode status; reconnect oxygen supply to re-enable; if still unresponsive, service required
Moisture inside loop	Water ingress from mouthpiece, ADV, or hose connections	Bail out; exit dive; clean and dry system before next use

Scrubber duration shorter than expected	High workload, cold water, exhausted absorbent, non-approved absorbent. All validation is based upon Sofnolime™ 797.	Replace scrubber material; verify absorbent material and procedure
Sensors values are greyed out	No calibration data are available	Calibrate the head
Failed linearity check in air	Halcyon GreenFlash™ Optode cell exposed to direct light	Recalibrate without direct light on the oxygen sensors

Post-Dive Fault Reporting

- Record the symptom, time, and dive profile.
- Note any alerts from HUD, handset, or vibration system.
- Report details to Halcyon Dive Systems or an authorized service center.

⚠ CAUTION

Do not attempt unauthorized repairs to electronic, oxygen control, or pressure components. Service must be performed by authorized personnel only.

Appendix C: Checklists

NOTICE

Operational compliance

Completion of these checklists is mandatory to maintain the safety and CE certification of the Symbios CM Rebreather.

HALCYON™ SYMBIOS

Name		Date	

_Calibration Checklist

O_2 Sensors Manufacture Date

Sensor 1 (Galvanic)	Sensor 2 (Galvanic)	Sensor 3 (GF or Galvanic)

Analyze O_2

%

- [ ] Recent IP check (~7 bar)
- [ ] Attach O_2 reg to O_2 bottle. Check all hoses and connections
- [ ] Check solenoid and MAV injection holes
- [ ] Fit calibration cap to head
- [ ] Pressurize O_2
- [ ] Verify Handset/HUD dive mode and pairing

Battery Check

Handset	CCR Head	GF O_2 Sensor	HUD
%	%	>2.6v	%

- [ ] Start calibration sequence (hold CCR button for 7 seconds)
- [ ] When prompted, turn off O_2
- [ ] Remove calibration cap when "Check Air" shows
- [ ] Confirm calibration successful (no error messages afterwards)
- [ ] Remove O_2 Bottle

_Assembly Checklist

- [ ] Calibrate O_2 sensors
- [ ] Check scrubber bolts and sponge
- [ ] Fill the scrubber
- [ ] Fit sponge and mesh
- [ ] Check scrubber O-ring
- [ ] Insert scrubber into canister. Check for proper orientation
- [ ] Check scrubber injection holes
- [ ] Check head O-rings and O_2 injection holes
- [ ] Attach head to scrubber
- [ ] Attach MAV feed to head
- [ ] Fit unit into bag and check O_2 straps
- [ ] Install BOV/ADV (OC mode)
- [ ] Fit diluent feed hose and verify routing
- [ ] Check O-rings at counterlung attachment
- [ ] Attach counterlungs

↓

- [ ] Fit bag to BOV/ADV
- [ ] Route OPV string
- [ ] Attach O_2 cylinder (keep O_2 turned off)
- [ ] Attach O_2 regulator to the bottle
- [ ] Check loop one-way valves
- [ ] Visually inspect mouthpiece
- [ ] Inspect loop O-rings
- [ ] Fit loop and verify it's secure
- [ ] Check mouthpiece and breathing hose rotation
- [ ] Switch BOV/ADV to CC
- [ ] Perform negative check (O_2 depressurized)
- [ ] Perform positive check (O_2 depressurized)
- [ ] Place inhalation lung over BOV/ADV
- [ ] Close bag zipper and Velcro
- [ ] Turn on handset and HUD
- [ ] Turn on O_2 bottle
- [ ] Confirm handset and HUD receive O_2 values
- [ ] Check O_2 pressure
- [ ] Test BOV/ADV functionality (OC/CCR)
- [ ] Check SP button operation (Auto, Low, High)

If not diving now:

1_Turn off and depressurize O_2
2_Close DSV
3_Switch to OC mode
4_Check head, handset and HUD power down

Onsite Checklist

- [ ] Check battery levels
- [ ] Check O_2 pressure
- [ ] Perform neg/pos checks (if transported since assembly)
- [ ] Analyze Dil
- [ ] Pressure Check Dil
- [ ] Check Dil IP

Pre-Dive Checklist

Step	Item	Description
C	Controller & Connectivity	Cycle through setpoint and ensure solenoid action. Check dil feed hose, check if unit is fastened to diver, check HUD mounting, verify wireless connection with handset and HUD.
H	Handset/HUD	• Verify settings • Battery level • Hud mounting • Verify auto BO function
A	ADV	• Flow check valve • Check ADV in OC mode • Diluent flush→O_2 addition • Check ADV works in both standard and CC+ modes
O	Oxygen	• Pressure check • MAV O_2 addition
S	System	SP 0.5 stability check for 4 mins

HALCYON™ AMBIO

24587 NW 178TH PLACE HIGH SPRINGS, FL 32643, USA

1.800.HALCYON (425.2966)

HALCYON.NET