

The rEvo: manual/electronic/hybrid CCR

End of march 2008 rEvo rebreathers will start supplying the new electronically controlled rebreather, available in either pure electronic or hybrid mode.

The electronically controlled rebreather is always based on the standard mCCR rEvo, with 2 independent PPO2 monitors (the rEvodreams), on which an electronic upgrade package is installed. In case of complete failure of the controller, the unit can be dived as a standard mCCR rEvo, still having both rEvodreams.

For the controller rEvo rebreathers choose to work together with Shearwater Research inc (Canada). The controller has an integrated trimix deco-computer based on Buhlmann with GF adjustment, reading 3 cells and using voting logic, and a 'rEvo'-adapted solenoid injection logic to keep the PPO2 at the desired level.

The controller has its own internal, user replaceable battery, and uses an external battery to activate the solenoid.

The Hybrid mode uses a unique operating principle: it combines the advantages of the stable mCCR constant mass flow, with a PPO2 controller that tracks the PPO2 towards the desired set-point. The hybrid unit has both an orifice, fed by an absolute pressure regulator, and a solenoid controlled valve. This way the unit can be used in any desired working mode, from pure mCCR up to full electronic eCCR, without the depth limitation linked to the absolute pressure used in mCCR systems.

Different working modes:

pure mCCR: (seldom used)

In the extreme case the diver does not want to have the automatic valve injecting oxygen, this valve can be easily blocked with a plug: the diver flies the unit purely mCCR, like the standard rEvo, with the orifice constant bleeding oxygen, and adding manually oxygen when needed; but with the shearwater controller he can use the integrated trimix deco-computer, reading out 3 cells.

mCCR with electronic parachute (backup) system:

The diver uses both the bleeding orifice, and the electronic valve, but uses the low setpoint on the controller, and flies the unit like a pure mCCR. The controller will not inject any oxygen, unless the diver does not watch his PPO2 correctly, does not see the indications on the HUD's, and the PPO2 drops below the set-point: only then the controller will add oxygen to the breathing loop and prevent hypoxia. This is especially useful at surface, while swimming and not watching the PPO2 dropping due to the higher workload, and while HUD's are sometimes worse to see because of strong sunlight.

eCCR with orifice bleeding:

Both the orifice and controlled valve are used, and the diver uses the high set-point: the PPO₂ is maintained constant by the controller, but the valve must inject much less because during quite diving nearly all the oxygen needed to maintain metabolic consumption, is supplied by the bleeding orifice. (This means the battery use of the solenoid will only be a fraction of the normal pure eCCR mode).

This mode can be used up to max 80 meters, because the absolute pressure of the oxygen first stage is kept constant, even by increased depth.

pure eCCR:

When the diver wants to go deeper than 80m, the previous modes can not be used any more, because when the orifice is used, the 1st stage must be transformed into an absolute pressure regulator: this way the pressure will not increase when the diver descends. But reaching 80m, the intermediate pressure comes nearer to the absolute pressure in the water, and so nearly no more pressure is available for the orifice and the valve, and no more oxygen can be added to the loop. When going deeper than 80m, the 1st stage must be transformed again to a standard regulator (by simply taking off the absolute pressure cap), and the orifice must be blocked (with the same plug that is used to block the valve in the pure mCCR mode), if not the flow through the bleeding orifice would increase by greater depth, become higher than the metabolic consumption, and make the breathing gas hyperoxic.

When this done (no absolute pressure cap on the regulator, and the orifice blocked), the rEvo works as a pure eCCR, with low and high setpoint, and all needed oxygen is supplied by the electronically controlled valve. The manual addition valves are still there to add any gas to the loop when needed. There is no more depth limit because of the absolute intermediate pressure, but rEvo advises to use the unit not deeper than 100m.