GAS ANALYSIS SOLUTIONS FOR MILITARY DIVING
INTRODUCTION

Analox Military Systems (AMS) is part of the Analox Group, a specialist producer of gas monitoring solutions for hostile environments. AMS was created in 2011 specifically to meet the requirements of the military market. Its continuing success is the result of innovations such as miniaturised infra-red gas sensors that work at hyperbaric pressures. Our gas monitors are used in diving life-support systems around the world.

AMS’s UK-based manufacturing and service centre is fully compliant with export licensing requirements and the International Traffic in Arms Regulations (ITAR). We are wholly committed to pushing the boundaries of what can be achieved in hostile, safety critical environments. Not only do we supply standard, cutting-edge gas monitoring equipment, we can also provide bespoke solutions for niche markets and special projects.

EXPERTISE

AMS has supplied gas monitors to military divers for over thirty years. From surface-supplied and mixed-gas through to saturation dive systems, our products are guaranteed to look after the air you breathe. AMS has gained an enviable reputation as a globally recognised brand with extensive experience in gas monitoring. We have supplied systems capable of working at pressures up to 60BarA, reliably and accurately, whilst also conforming to Lloyds and DNV requirements. We offer the perfect choice of diving gas monitors for use by:

- mine clearance divers
- naval salvage
- search and rescue
- military and defence
- police and security
- special operations
SOLUTIONS

AMS’s off-the-shelf products are designed to monitor oxygen, carbon dioxide, carbon monoxide, helium, hydrocarbons, temperature, pressure and humidity. In addition, our bespoke design capability ensures our expertise is the first choice for specialist gas monitoring. A number of our monitors are now NATO-coded. Our systems generally provide one or more of the following life-safety functions for diving environments:

- analysing the output from air compressors to detect contaminants in breathing air
- monitoring decompression chamber gases and environmental parameters (depth, temperature, humidity)
- monitoring breathing gas delivered to saturation and air divers
- detecting pre-anaesthetic concentrations of hydrocarbons in the diving bell
- monitoring the levels of carbon monoxide
- measuring contaminants in gas reclaim systems
- verifying the correct mix of dive cylinders
SATURATION DIVING

A successful diving operation depends on a comfortable, safe environment and accurate gas monitoring at every stage of the diving process. Whether this involves checking for hydrocarbons in diving bells, detecting gas leaks in the control room or monitoring oxygen in the decompression chamber, AMS has the solution...

SDA SATURATION DIVING ANALYSER

SDA is a range of panel/rack mountable atmosphere monitors designed for saturation diving. Each unit has a full colour display, audio/visual alarms, optional data-logging and 4–20mA/relay outputs.

The SDA range of analysers ensures that every aspect of a diver’s safety is being monitored while they are in saturation from gas delivery to the chamber environment.

The modular design lends itself to being fully maintained by the operator in order to minimise downtime, as well as simplifying the through-life support of the system to maximise its operational life.

The SDA display panel is typically located in Sat or Dive Control, the individual gas or environmental sensors can be located in Sat or Dive Control (supplied by sample lines) or located within the hyperbaric environment.

SDA OXYGEN

Oxygen is one of the most critical parameters to monitor on any dive system, it is vital the divers receive the correct partial pressure (pp) of O2 in order to live and work comfortably while in saturation. Analox offers two O2 sensing technologies for the SDA:

- The electrochemical sensor version uses Analox’s state-of-the-art digital MEC electrochemical sensor to provide oxygen readings. It is normally located in Sat/Dive Control; the sensors can be located at the panel or in the chamber/bell. The SDA O2 is compliant with DNV, IMCA, Lloyds, ABS, and ADCi requirements.
- The paramagnetic O2 sensor uses Analox’s state-of-the-art digital paramagnetic O2 sensor to offer enhanced accuracy when monitoring low concentrations of O2.

Either version can be used for monitoring O2 concentrations in the:
- decompression chamber
- diving bell
- O2 delivered to divers through the umbilical
- O2 added to helium reclaim systems
**SDA CO₂ (CARBON DIOXIDE)**
As a by-product of human metabolism CO₂ should be carefully monitored in any dive system. The SDA CO₂ is compliant with DNV, IMCA, Lloyds, ABS, and ADCi requirements. Carbon dioxide readings are taken from a fast response, accurate, dual-beam infra-red sensor, called the ‘Analox 5S3’. It is normally located in Sat/Dive Control, however if hyperbaric CO₂ monitoring is required Analox would offer their unique SDA HYP O₂/CO₂, based on 30 years of experience in hyperbaric gas sensing.

**SDA DEPTH**
Diving chamber depth readings are used in combination with gas readings to calculate the partial pressures and thereby ensure the safety of divers. The accuracy offered by the SDA Depth is compliant with DNV, IMCA, Lloyds, ABS, and ADCi specifications. The SDA Depth display unit is normally located in Sat/Dive Control and its pressure sensor is mounted in the hyperbaric environment.

**SDA CARBON MONOXIDE**
Carbon monoxide is highly toxic and can be tolerated only at very low levels in a dive system. CO can enter the dive system through a compressor; it could also be present in the delivered gas and metabolised by the divers in the chamber during operations. The SDA CO provides readings from a fast response, accurate, long-life digital electrochemical sensor. The SDA CO can be located either in Sat/Dive Control or at the compressor. For more accurate NORSOK & EH75/2 monitoring of CO, AMS offers the SDA CO+.
**SDA CARBON MONOXIDE +**
The SDA CO+ offers increased accuracy over the SDA CO by incorporating an advanced electrochemical cell which measures CO in parts per billion (ppb) instead of parts per million (ppm). The SDA CO+ complies with NORSOK 4–100, EH75/2 and BS8478 standards and can be located in the Sat/Dive Control or compressor.

**SDA TEMPERATURE & HUMIDITY**
Temperature and humidity in a chamber or dive system have a significant influence on the comfort and well-being of divers. A relatively small change in temperature is hazardous due to the thermal conductivity of helium; high humidity can encourage microbial growth which may cause health problems. The SDA T&H monitor may be located in either the Sat/Dive Control or at the compressor interfaces. The SDA unit is connected to a dual temperature and humidity probe which may be located in either the chamber or the gas pipework.

**SDA HELIUM**
Helium is an expensive gas which is routinely salvaged from breathing air systems. Monitoring the purity of heliox in a reclaim system can improve both cost efficiency and diver safety. The SDA He is normally located in a helium reclaim area and used in conjunction with an SDA O2, which has the networking option selected.
HYP PORTABLE INDEPENDENT O2 MONITOR

Diving industry guidelines require that each hyperbaric chamber is provided with independent oxygen monitoring in the event of a primary gas monitor failing. The HYP is AMS’s portable, partial pressure O2 monitor designed for use inside the living chamber, hyperbaric lifeboat or diving bell. It is a compact, easy-to-operate device that accurately measures the partial pressure of oxygen (ppO2) within the hyperbaric environment.

HYPER-GAS MkII HYPERBARIC HYDROCARBON MONITOR

Small quantities of hydrocarbons in the diving bell can act as an anaesthetic and create a potentially fatal hazard for divers. The AMS Hyper-gas MkII is a unique hyperbaric hydrocarbon monitor designed to rapidly detect the presence of hydrocarbons and alarm at pre-anaesthetic concentrations.

The Hyper-gas MkII was designed in response to an incident in the North Sea, in which a diving bell was contaminated with hydrocarbons brought in from the seabed by a diver and is now recognised as ‘best practice’ within the commercial diving industry.

SAFE-OX+ OXYGEN ENRICHMENT AND DEPLETION MONITOR

The Safe-Ox is ideal for ambient monitoring of gas storage areas in order to detect leaks of O2 or inert gas. The monitor comprises a wall-mounted main sensor unit and a repeater, complete with audio visual alarms. Analox’s use of a long-life sensor ensures the unit is simple to operate and maintain it.
SURFACE-SUPPLIED DIVING

AMS gas monitors are used on hundreds of commercial surface-supplied (air diving) systems around the world. These enable customers to achieve IMCA compliance, benefit from minimal maintenance and put trust in their diving gas. Our surface-supplied diving product range is the most comprehensive in the world, yet we are aware that you may need something more specific, or a variation of an existing offering. Such experiences over the years have helped our products to evolve and ensured that we remain the number one choice.

AMS gas monitors for surface-supplied diving range from personal oxygen monitors to multi-gas monitors that check the quality of compressed air at the point of delivery to comply with standards, including:

- BS EN 12021
- BS 8478
- DEF STAN 68-284
- US Navy Dive Manual
- NAVSEA SS521-AK-HBK-010

ACG+ MULTI-GAS COMPRESSOR MONITOR

The ACG+ is available as either a fixed or a portable monitor commonly used ‘inline’ on air compressors.

As a continuous on-line monitor the ACG+ offers a significant opportunity for improvements in air sampling from the current practice of one-time colorimetric tube testing and periodic laboratory testing. The continuous monitoring approach provides you with instant information on the quality of compressed air helping to minimise equipment downtime and maximise equipment availability – thus delivering better value for money.
**CO CLEAR CARBON MONOXIDE MONITOR**

Carbon monoxide is a dangerous and potentially lethal gas, the effects of which increase with pressure as the partial pressure of CO increases. It can contaminate breathing air either by ingress through a compressor inlet, or via the compressor itself (as a result of poor maintenance). The CO Clear is installed inline on a compressor – after the compressor inlet but before the cylinders – to warn of potential CO contamination before it reaches the cylinders or users. A twin-stage regulator is recommended, to reduce the sample pressure down to between 1 and 3BarG before the main sensor unit installation. Optional extras include a relay which could be used to either switch off the compressor or sound a remote alarm.

**O2 PORTABLE OXYGEN MONITOR**

The O2 Portable oxygen monitor is a spot-checking device that measures the O2 concentration in oxygen and nitrox cylinders. It can also be used as a budget option for inline installation on air panels.

**ADM ASPIDA OXYGEN AND CARBON DIOXIDE MONITOR**

The ADM Aspida was developed in response to IMCA document DO23, in the commercial diving industry, which relates to diver safety. DO23 states that both CO2 detection and O2 monitoring (with alarms) are incorporated in surface-supplied diving systems. Analox would like to ensure surface supplied military divers benefit from this cost-effective product.

The ADM Aspida can also be used to analyse air quality from a portable decompression chamber, when provided with a sample line from the chamber. The ADM Aspida is designed to be operator maintained.
MIXED-GAS DIVING

To ensure safe mixed-gas diving it is essential to monitor the concentration of oxygen in the gas mix. Monitoring the oxygen allows you to ensure you are able to safely execute the dive you have planned. Using an incorrect concentration of O2 for a given dive depth can be fatal. AMS therefore offers a complete mixed-gas analyser package. Our analysers are tried and tested; some are NATO-coded. They offer valuable benefits to nitrox, trimix and heliox divers worldwide – including reliability, long life and minimal running costs.

O2EII PRO PORTABLE NITROX ANALYSER

The O2EII has traditionally been the preferred choice of nitrox analyser for military and scuba divers. Following market demand, an enhanced version – the O2EII Pro was developed, which incorporates a ‘hose barb’ that can receive air samples from a BCD adaptor. The hose barb allows the O2EII to be used either while checking the O2 content at the tank, or while connected to the first-stage regulator (via a BCD low pressure inflator).

The O2EII Pro is a highly accurate device, generally considered to be the most reliable nitrox analyser on the market. It is small, portable, lightweight and rugged.
ATA PRO PORTABLE TRIMIX ANALYSER

The ATA Pro is a compact, lightweight, portable trimix analyser offering oxygen, helium and balance gas readings in one unit. It takes readings directly from the cylinder and compensates the helium sensor for the oxygen present in the mix, thus providing a more accurate helium reading. The user can zero and span the helium sensor ensuring long-term accuracy of the unit.
REBREATHER DIVING

A rebreather is a type of self-contained breathing apparatus which allows the recycling of exhaled air. It works by removing excess CO₂ and gradually replacing the depleted O₂. Rebreathers incorporate both an O₂ supply tank and a canister of soda lime which absorbs, or ‘scrubs’, the CO₂ from exhaled air. This canister must be physically repacked with absorbent material before use, but this process has been known to fail. The injection of oxygen is controlled by an O₂ sensor. Analox has a history of providing quality sensors into this market and can supply magnetic and non-magnetic O₂ sensors to suit your requirements.

Safety is greatly enhanced by the integration of a CO₂ sensor in the rebreather. This provides early warning of an increase and gives the diver valuable time to take action. For rebreathers that are not required to be anti-magnetic, this solution is relatively simple. However, any that are specified to comply with STANAG 2897 Class A are compromised by using a CO₂ sensor with a typical (i.e. relatively high) magnetic signature.

AMS has recently undertaken research for a military supplier to develop a CO₂ sensor with an extremely low magnetic signature – a technology currently unavailable in off-the-shelf products. The availability of such a sensor would enable the production of gas-detection systems with a magnetic signature not larger than 5nT (nano Tesla), the limit specified by the NATO Standardization Agreement STANAG 2897 Class A.

Compliance with STANAG 2897 Class A is becoming an operational necessity for defence applications, particularly those involving mine clearance, special forces deployment or covert diving operations. AMS’s specialist staff are experienced in delivering functionally safe systems to IEC 61508, and no bespoke diving project is beyond their capabilities. Whatever your requirement, our design team can help.