

## STOP! BEFORE GOING FURTHER-

This manual will refer to location numbers in specific drawings, or in the exploded view, which is in the back of this manual. These numbers are called “location” numbers. They are used to find the referred to parts in the drawings in this manual only. They are not the part number. Next to the exploded drawing is a list of the “location” numbers that match the Kirby Morgan part numbers along with the name of the part. Always check the part number when ordering to make sure it is correct. When ordering, always specify the model number and serial number as well.

## Chapter 1.0 General Information

### 1.1 Definitions

The following terms may be unfamiliar to the reader. They are defined as they relate to this manual and diving. All parts locations are referenced by LETTER in the diagram on page 6.

**KMACS 5—Kirby Morgan Air Control System 5:** The Trademark name of the device this manual describes. The KMACS 5 contains all of the components necessary to properly control and monitor surface supplied air dives. Included in the KMACS 5 is a two-way voice communicator for talking between the KMACS 5 operator and the diver(s), or diver-to-diver. The communicator operates in both the two wire and four wire mode.

**Scuba:** Self Contained Underwater Breathing Apparatus.

**SSAir Diving—Surface Supplied Air Diving:** Diving operation where the diver is supplied breathing air by way of a hose which is part of the diver’s umbilical from the surface. Usually the source of the breathing air is a compressor, but compressed air tanks on the surface can also be used.

**Diver’s Umbilical:** Several components run together from the KMACS 5 to the diver. These components are joined together, usually by tape, forming the umbilical. The most common components used in the diver’s umbilical are: (A) a hose through which the breathing air flows to the diver; (B) a multiconductor wire for communications transmission; (C) another (smaller) hose which is used to show the diver’s depth on the pneumofathometer (*see pneumofathometer, this section*); (4) a strong line used as a strength member to prevent strain on the other components of the umbilical. In addition to shorter spaced taping, the umbilical should be taped every 10 feet with colored tape to indicate the length of the hose.

**High Pressure (H.P.) Hose:** A flexible hose designed to carry a working pressure of gas (or air) of more than 300 pounds (20.7 bars) per square inch. The rated working pressure is usually indicated on the hose and must not be exceeded. The working pressure of the high pressure system on the KMACS 5 is 3500 psi (240 bars)

**Whip:** A hose complete with fittings at each end for use in hooking up two pieces of deck equipment for gas (or air) flow. For instance, the hoses and fittings used to connect the KMACS 5 to the high pressure tanks are called “high pressure whips.”

**H.P.—High pressure:** Usually any pressure over 300 psi. (20.7 bars).

**L.P.—Low pressure:** Usually any pressure under 300 psi. (20.7 bars).

**Pneumofathometer:** (pronounced “new-mo-fathometer”) This device measures the diver’s depth. A small hose which is part of the diver’s umbilical runs from the KMACS 5 to the diver. The hose is open at the diver’s end and attaches with a fitting to a gauge at the KMACS 5. The gauge is calibrated in feet and meters of sea water. A valve is installed on the upstream side of the gauge so the operator can use a small amount of breathing air to purge the water from the hose. When the hose has been purged of water and the valve is closed the excess air bubbles out of the end of the hose at the diver’s end. The air left in the hose will be at the pressure of the water column and will show the exact depth of the diver on the diver’s pneumo gauge.

**Pneumo:** Short for pneumofathometer. Used such as “pneumo-gauge,” “pneumo-valve”, “pneumo-hose”, to describe the parts that make up the pneumofathometer subsystem.

**Dressed-in:** A commercial diver's suit was originally called a "dress." Although the name changed to "suit" the term "dressed-in" has remained to describe putting the suit on. A diver who is "dressed-in" has a suit on. The term is also used to describe a diver who, in addition to his suit, has more, or all of his/her equipment on.

**Bailout Bottle:** This is the emergency tank of breathing gas. "Bailout" which is the familiar term for parachuting from an airplane, also applies to the shallow water diver who ditches part of his diving gear and swims to the surface. The "bailout" bottle term came from this use.

The bailout bottle is an independent air source connected directly to the diver's mask or helmet via a first stage scuba regulator and hose. The first stage regulator must be equipped with an overpressure relief valve (Part #200-017). The overpressure relief valve will vent pressure in the event of a first stage leak and prevent the low pressure hose from rupturing, causing a complete loss of the diver's bailout supply.

The bailout bottle is worn on the diver's back, mounted to a harness. The diver's umbilical should be attached to this harness to prevent a direct pull on the diver's mask or helmet.

The size/volume of the bailout bottle should be determined by the diver's depth, or the distance required for a direct ascent to the surface. For deeper dives, or penetration dives inside wrecks or pipelines, a larger capacity bailout bottle should be used.

The volume must be determined by the hazards of the dive, but should always allow at least 10 minutes breathing supply.



Figure 1 Divers with all of the gear they need to dive.

## 1.2 Design Purpose

The Kirby Morgan Dive Control System 5 (KMACS 5) is designed to provide a central control center for the operator/dive supervisor during a surface-supplied air dive. Provisions for the control of the breathing air supply, diver depth monitoring, and voice communications are all located on a simple panel. The KMACS 5 is a full service control system for all Surface Supplied Air diving operations.

The KMACS 5 is fitted with shut off valves on the diver's air supply. The shut off valves are designed to allow air to be shut off on either or both of the diver's umbilicals. When the handles of the valves are vertical the valves are open and air is flowing to the divers. When the valve handles are horizontal the valves are shut and the air to the divers umbilicals is off.

By having total control located at one panel, the KMACS 5 operator can rapidly respond to the diver's needs without leaving the control station. In a standard commercial Surface Supplied Air (SSAir) diving operation the KMACS 5 provides a backup air supply system which the operator can activate in the event of the main air supply failure (such as compressor malfunction). This can be accomplished without leaving the control panel, which allows the operator to inform the diver and continuously monitor umbilical supply pressure and depth at the same time.

The compact size of the KMACS 5 usually makes it possible to locate it at the water entry site, allowing the operator to tend the diver's umbilical while maintaining control of the KMACS 5.

In addition to its compact size, the ability of the KMACS 5 to use high pressure air allows SSAir diving from small boats or remote locations where transportation and setup of a compressor would be impractical. Two or more standard scuba bottles can be used as the breathing air supply.

For example, when commercial divers are working on an offshore rig, a common SSAir diving job is the inspection and cleaning of a propeller on a crew boat. This job can be performed easily and simply with the KMACS 5, a couple of scuba bottles, a full face mask or helmet, and an umbilical. Transportation to the job site is simple and a large surface support vessel is not needed. At the dive site, full communications, backup breathing supply, pressure readouts, and depth monitoring are provided by the KMACS 5.

This is one of many situations where the KMACS 5 can be used to provide the safe and efficient operation of SSAir diving.

## 1.3 Specifications

**Use:** For SSAir diving only. Enriched air (Nitrox) or pure oxygen **MUST NOT** be used. Compressed air from high pressure tanks (scuba or other types of compressed air tanks), or from a compressor should be the only supply to the KMACS 5

### **⚠ WARNING**

**Pure oxygen is a potential fire hazard, its use can lead to explosion of the KMACS 5. Pure oxygen also presents a physiological hazard to the diver.**

Outer Dimensions: Length = 21 inches  
Width = 18 inches  
Height = 11 ½ inches

**Weight:** 54 pounds. (24.5 kilos)

Shipping Weight: 60 pounds. (27 kilos)

### **⚠ CAUTION**

**Decompression and other human limits must be observed. Decompression diving should not be conducted with the KMACS 5 unless a properly equipped recompression chamber facility with oxygen is immediately available at the dive site. In-water decompression is not recommended.**

Recommended Maximum Dive Support Depth: 130 fsw (feet of sea water) (40 meters).

### **High Pressure Supply Pressure Recommended Maximum:**

3500 psi. (240 bars) using the DIN fitting  
3000 psi (200 bars) using the yoke

### **NOTICE**

**Although the high pressure gauges on the KMACS 5 are rated to 5000 psi (345 bars), this is a safety precaution only. The regulator on the KMACS 5 is not designed to operate at pressures greater than 3500 psi (240 bars).**

**Low Pressure Supply Pressure Maximum:** 250 pounds per square inch. (15.5 bars)

**Umbilical Pressure Range:** 115-225 pounds per square inch. (8-15.5 bars)

Regulator Output: 40 SCFM at 2500 psi (172 bars) supply pressure with 150 psi (10.3 bars) delivery pressure.

Relief Valve: Set at 300 psi (20.7 bars).

Pneumofathometer Range: 0-250 FSW (feet of sea water) (0-76 meters).

Communicator: 4 wire system. Can also be used in 2 wire mode.

Battery Type: Rechargeable, 12 volt system.

Battery Performance: 20 hours of continuous use between charges in 4 wire mode.

Charger: Will accept external 12 volt source.

Communicator Power Output: 20 watts.

Communicator Frequency Response: 600 to 12,000 HZ.

**Direct Recording Capability:** Yes.

## 1.4 General Description

The KMACS 5 components are housed in a durable polyethylene case. However, caution should be used in transporting the KMACS 5. Rough handling will rarely cause damage to the case, but it is possible to damage the calibrated pneumo gauges and/or the electronic components. The KMACS 5 should be treated as you would any expensive life support equipment.

### 1.4.1 Breathing Air Subsystem

The diver's breathing air subsystem starts with the supply tank yokes (T) and connects to the diver's supply manifold. The high pressure hoses with the yokes are stored for transit by connecting them to the posts on the panel inside the lid of the KMACS 5. The knurled knobs on the yokes should be tightened until just snug. Excessive force should not be applied.

### 1.4.2 Principle Operating Features

## 3. Dive Control Panel (A)

The panel is the main frame to which the functional components are mounted. In addition, the component

names and some instructions are on the panel. The blue and orange lines (L, R) on the panel represent the flow paths of supply air from the two high pressure hoses/yokes (T).

### 4. Red Diver Depth Gauge (C) (Pneumofathometer)

This gauge indicates the “red” diver depth. The red diver pneumo valve knob (D), is turned to supply a small volume of air to the small pneumo hose that is part of the diver’s umbilical. The gauge reads the pressure of the air in the pneumo hose. This pressure, measured in feet (or meters) of sea water, equals the water pressure at the diver’s depth. Red diver pneumo hose is attached to the red side fitting (F)

### 5. Umbilical Pressure Gauge (B)

This gauge (B) is connected to the low pressure air supply system that supplies both umbilical fittings. It indicates the breathing air pressure that is in both the “red” and “white” diver umbilicals. When the air supply is from high pressure tanks (such as scuba tanks) the umbilical hose pressure can be varied by turning the regulator adjustment knob (I)

### 6. White Diver Depth Gauge (Q) (Pneumofathometer)

This gauge indicates the “white” diver depth. The white diver pneumo valve knob (P), is turned to supply a small volume of air to the small pneumo-hose that is part of the diver’s umbilical. The gauge reads the pressure of the air in the pneumo-hose. This pressure, measured in feet (or meters) of sea water, equals the water pressure at the diver’s depth. White diver pneumo hose is attached to the white side fitting (F).

### 7. Blue Air Supply Flow Indicator Line (R)

The “BLUE” air supply flow indicator line (R) indicates the flow path of breathing air from entry into the KMACS 5 to exit to the diver’s umbilical(s) at the fittings on the manifold (E). There are two high pressure whips which are color coded BLUE and ORANGE.

Starting from the high pressure air tank, the BLUE air supply flows through the whip into the KMACS 5. Following the BLUE flow indicator line (R) it shows the flow to the BLUE Breathing Air Supply Pressure Gauge (N), then to the Breathing Air Supply Selector Valve which is controlled by the Breathing Air Selector Valve Handle (J). The Selector Handle (J)

must be turned all the way “UP” until it stops for the BLUE supply. This places the selector valve handle in line with the flow path indicating the “BLUE” air supply (R). The ORANGE supply is off when the Selector Handle is in the up position.

After flowing through the Selector Valve the BLUE air supply enters the Breathing Air Supply Regulator (I) which reduces the high pressure breathing air to an adjustable range between 115-225 pounds per square inch (psi) (8-15.5 bars). The BLUE air supply then goes to both diver’s umbilicals through the fittings on the manifold (E).

## **⚠ CAUTION**

**When using H.P. air, the selector handle must be turned up until it stops for BLUE supply or down until it stops for Orange supply. Never allow the selector handle to stay in the marked “H.P. OFF ZONE”. Both high pressure air supplies are off in the yellow striped H.P. OFF ZONE”.**

### 8. Orange Air Supply Flow Indicator Lines (L)

The “ORANGE” air supply flow indicator line indicates the flow path of breathing air from entry into the KMACS 5 to exit to the diver’s umbilical(s) at the fittings on the manifold (E). The second high pressure whip is color coded ORANGE.

Starting from the high pressure air tank, the ORANGE air supply flows through the whip into the KMACS 5. Following the ORANGE flow indicator line (L) it shows the flow to the ORANGE Breathing Air Supply Pressure Gauge (M), then to the Breathing Air Supply Selector Valve which is controlled by the Breathing Air Selector Valve Handle (J). The Selector Handle must be all the way “DOWN” until it stops for the ORANGE supply. The BLUE supply is off when the Selector Handle is in the down position.

After flowing through the Selector Valve the ORANGE air supply enters the Breathing Air Supply Regulator (I) which reduces the high pressure breathing air to an adjustable range between 115-225 psi (8-15.5 bars). Then the ORANGE air supply goes to both diver’s umbilicals through the fittings on the manifold (E).

The air supply to both divers can be controlled by shut-off valves located on the manifold (H). When

the valve handle is up (vertical) the valve is open. When the valve handle is down (horizontal) the valve is closed.

**9. Low Pressure Inlet Fitting (O)**

The low pressure inlet fitting is positioned between the connections for the two H.P. supply hoses. It is marked by the arrow containing the words “L.P. Supply”. Low pressure supply breathing air, usually from a compressor (with volume tank) is supplied through a whip (low pressure hose and fittings) that attaches here. When the low pressure supply is the only air source, the supply pressure will be indicated on the umbilical pressure gauge (B). In the low pressure supply mode, the selector/valve handle will be positioned in the H.P. OFF ZONE.

**10. Blue Breathing Air Supply Pressure Gauge (N)**

The Blue supply pressure gauge (N) indicates the pressure remaining in the “BLUE” high pressure tank. (NOTE: If two divers are supplied by the KMACS 5 both divers will be breathing from the same selected high pressure supply).

**11. Orange Breathing Air Supply Pressure Gauge (M)**

The Orange supply pressure gauge (M) indicates the pressure remaining in the “ORANGE” high pressure tank. (NOTE: If two divers are supplied by the KMACS 5, both divers will be breathing from the same selected high pressure supply).

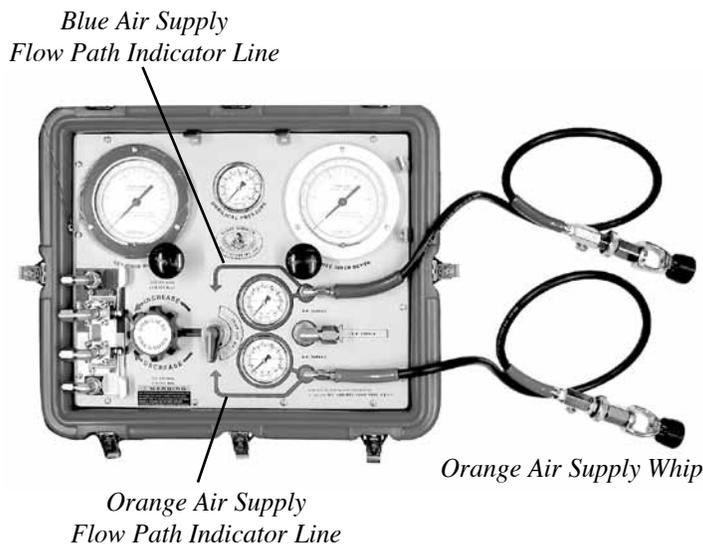
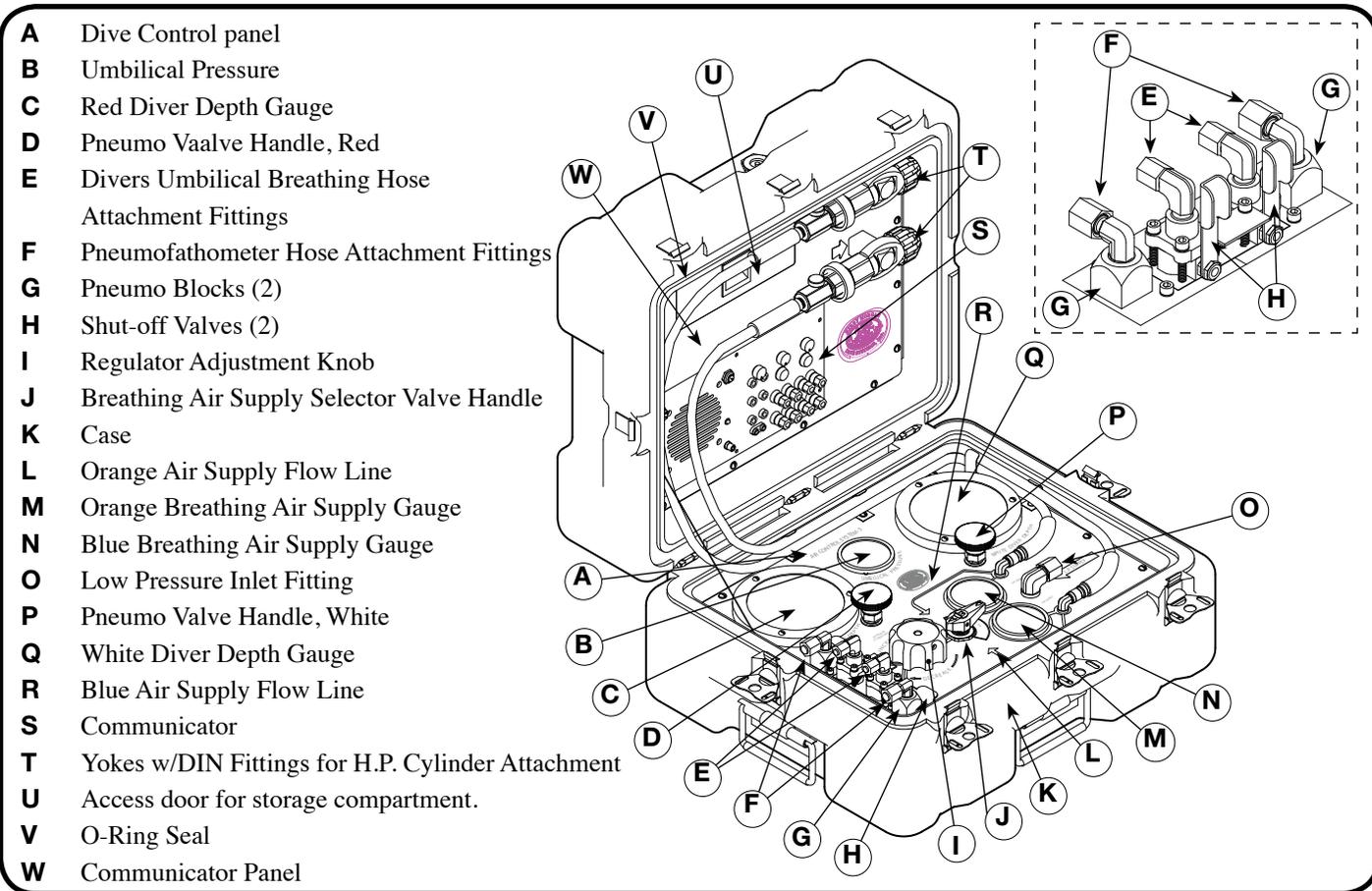


Figure 2 Air flow paths from the H.P. cylinders.



### 12. Yokes For High Pressure Cylinder Attachment (T)

The yoke fittings (T) provided have standard U.S. scuba cylinder attachments as well as Din Fittings. Each yoke has a bleeder valve to vent the remainder of the pressure in the whip when changing out scuba bottles. The yokes attach to posts mounted on the panel in the lid of the KMACS 5 for storage and transport.

### 13. Case (K)

The Dive Control panel assembly (A) is attached to the bottom half of the case (K). The top half of the case contains the communicator panel with the yoke blocks and the communicator if there are communications. If there are no communications there are only the yoke blocks. ( see picture in front of manual). The top is not designed to be removed.

### 14. Breathing Air Supply Selector Valve Handle (J)

This handle (J) controls the two position Breathing Air Supply Selector Valve and allows uninterrupted diving operations while full air supply tanks <sup>Figure 3</sup> replace expended tanks. The selector valve controls **ONLY the high pressure air supply**. It is NOT possible to shut off any low pressure supply connected to the low pressure inlet fitting (O), at the KMACS 5 itself.

When changing out the H.P. air supply cylinders, always observe the diver's umbilical pressure gauge (B) for any sudden fall in pressure. Should this occur, it indicates that the cylinder in use has mistakenly been turned off. If so, immediately turn the cylinder back on and move the selector valve handle to select the full cylinder and change out bottles.

Due to the construction of the selector valve, it is not possible for gas to back-flow from one cylinder to the other.

#### **⚠ CAUTION**

**When using H.P. air, the selector handle must be turned up until it stops for BLUE supply or down until it stops for ORANGE supply. Never allow the selector handle to stay in the marked "H.P. OFF ZONE". Both high pressure air supplies are off in the yellow striped H.P. OFF ZONE".**

### 15. Regulator Adjustment Knob For Umbilical Pressure (I)

The regulator Adjustment Knob (I) allows the operator to adjust the umbilical pressure within a range of 115 psi to 250 psi (8-17 bars). Incoming high pressure air from the "ORANGE" or "BLUE" supply is reduced by the internal regulator. The Adjustment Knob controls the regulator. Turning the Knob clockwise decreases the umbilical pressure; counterclockwise increases it.

### 16. Outlet Manifold Including Diver's Umbilical Fittings (G)

The "WHITE DIVER" and "RED DIVER" air supply umbilicals are connected to the KMACS 5 at the manifold (E). The standard fittings coming out of the KMACS 5 are male #6 JIC ( $\frac{3}{8}$ ", 37°) flared fittings—other fittings for other umbilicals may also be used. The diver's air supply hoses must have matching female fittings. Shut-off valves are positioned between the manifold and the diver's air fittings. The air is on when the valve handle is vertical and is off when the valve handle is horizontal.

The "WHITE DIVER" and "RED DIVER" pneumofathometer hoses are also connected to the KMACS 5 at the manifold (F). The fittings coming out of the KMACS 5 are male #4 JIC ( $\frac{1}{4}$ ", 37°) flared fittings. The diver's pneumofathometer hoses must have matching female #4 JIC ( $\frac{1}{4}$ ", 37°) flared fittings with swivel nuts—other fittings may also be used.

### 17. Pneumo Valve Knob, White Diver (P)

The Pneumo Valve Knob, White Diver turns on and off the air supply to the "WHITE" pneumofathometer system.

### 18. Pneumo Valve Knob, Red Diver (D)

The Pneumo Valve Knob, Red Diver turns on and off the air supply to the "RED" pneumofathometer system.

### 19. O-Ring Seal (V)

The O-ring seal helps keep dust and moisture out of the KMACS 5 when the case is closed. The O-ring seal is not pressure proof, however, and the KMACS 5 case will flood if the box is submerged.

**20. Communicator Panel (W)**

The diver’s electronic communicator (S) is attached to the communicator panel. The battery for the communicator is located behind this panel.

**21. Communicator (S)**

The KMACS 5 communicator is a standard open circuit/round robin diver’s communicator, which functions like a telephone. It can also be used as a 2 wire, “push-to-talk” system. It is connected to the diver’s umbilicals by “banana plug” fittings on the communicator. The communicator is mounted on the communicator panel. You should read and understand the accompanying radio operations manual supplied with the unit before using the unit. Improper use or connections could damage the radio.

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| <p><b>⚠ CAUTION</b></p>                                                                                                                                                                                                                        |
| <p><b>Never connect the charger during a dive or when anyone is in contact with connected equipment. Although electrical shock danger is remote, connection of the recharging cord should only be done when the KMACS 5 is not in use.</b></p> |

